PAPERS

IN

MECHANICS.

The GOLD MEDAL *of the Society was this Session voted to Mr.* WILLIAM HOOKEY, *of Woolwich, for his Improved Method of Bending Timber, for building large Ships of War. The following Communication was received from him, explanatory Engravings are annexed, and Models of the Invention are preserved in the Society's Repository.*

GENTLEMEN,

I HAVE invented and brought into practice, a machine for bending timber for the use of His Majesty's navy and large vessels: viz. floor-timbers, futtocks, breast-hooks, long riders, beams, knees, &c.

The constant want of compass timber, and the difficulty of obtaining it, is apparent, and seems to increase every year. The consequence is manifest to all persons who have knowledge of ship-building, and the high importance of whatever relates to the British navy, requires no comment.

The method adopted by me, has not only the effect of lessening the consumption of timber, but of adding strength to that which is used, as the timber can be worked much longer without being cut across the grain, which is frequently the case, and indeed unavoidable in the usual mode of moulding ship-timbers.

In the building of a seventy-four gun-ship on my plan, a saving will be made of about fifteen hundred pounds, and a general saving to the country of fifty thousand pounds per annum, in ship and boat building; and this is not the only advantage, as my mode will give a constant supply of timber, which cannot otherwise be obtained.

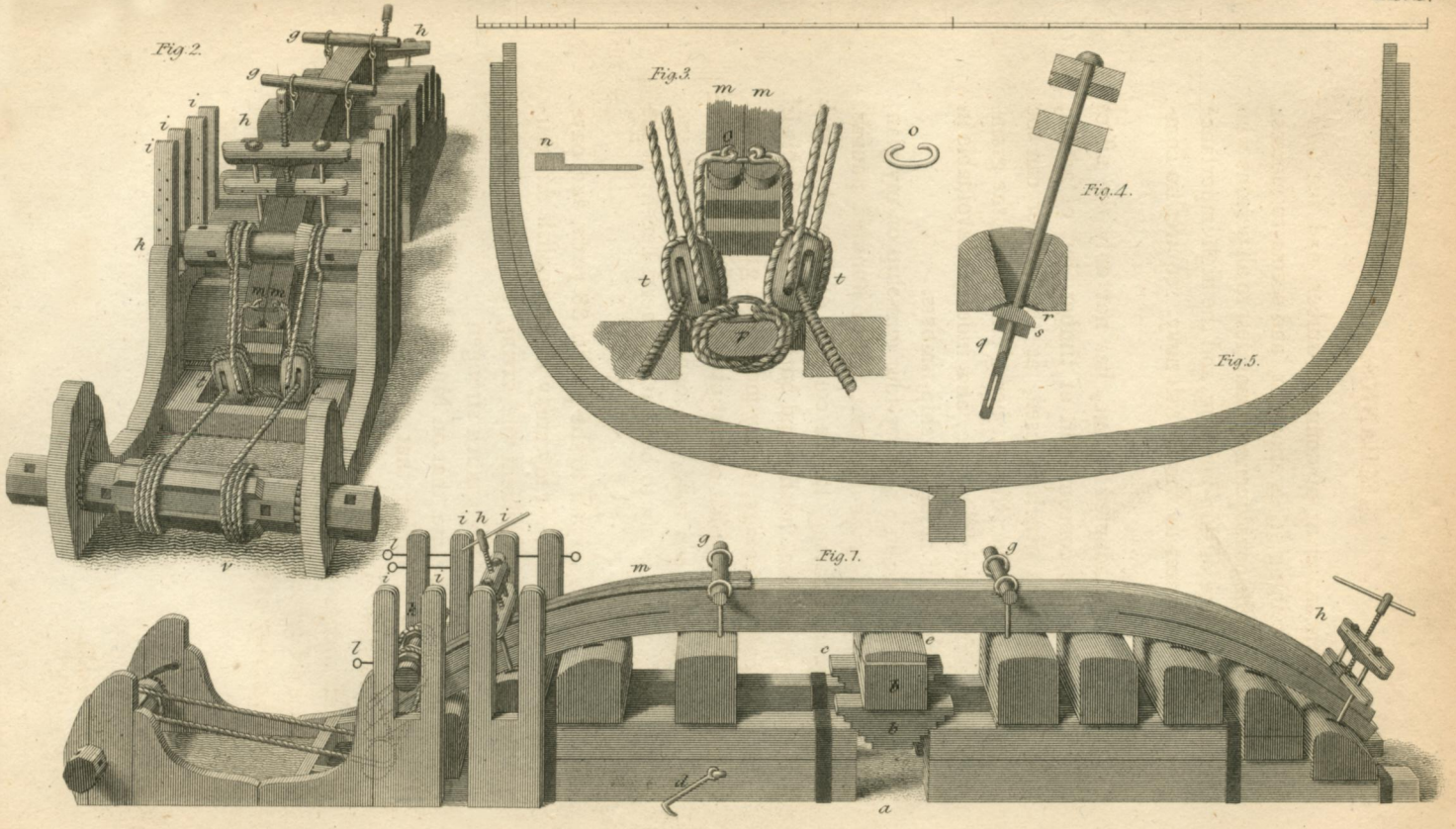
My plan has been tried, and found to answer every end intended, and is likely to become a general benefit to the united kingdom.

I have been a servant to the public 38 years, and have for some years made it my study to accomplish this purpose; and I am confident the saving will be immense, and the ships and boats much stronger.

I beg leave to state, that on May 2nd, 1813, I bent the largest piece of timber that ever was bent in England, to a four-feet eight-inch curve, in thirty feet long, and sixteen inches square, for a floor timber for the Black Prince, of seventy-four guns, in eight minutes time. This was a saving of twelve pounds sterling in one floor timber.

I hope

PL. 4.



M.r W.m Rookey's Machine for Binding Large Ship Timber.

Drawn by Cornelius Varley.

Engraved by Ja.s Davis.

I hope this invention will be found deserving of the attention of the Society.

I am, Gentlemen,

Your most respectful, obedient Servant,

WILLIAM HOOKEY.

To the Society of Arts, &c.

Woolwich, Jan. 28th, 1813.

CERTIFICATES,

IN pursuance of Commissioner Cunningham's directions of the 2d February, 1813, we have caused a trial to be made of the plan invented by Mr. Hookey, master boat-builder of this yard, for bending large timber, and the undermentioned articles have been brought to the curves required from streight timber: viz.

English oak, 3 pieces. } For floors for the Black Prince,
Canada oak, 4 pieces. } the curve about four feet.

The above, when taken off the machine, came up from 1½ to 2 inches, and were brought to the form required without injury. The time of bending the above floors, was from eight to ten minutes; and, in our opinion, the bending of large timber on Mr. HOOKEY's plan, is an object deserving every encouragement.

E. SISON, Master-Shipwright.
WM. STURE, } Builders Assist-
G. BODY, } ants.

Woolwich Yard, July 14th, 1813.

SIR,

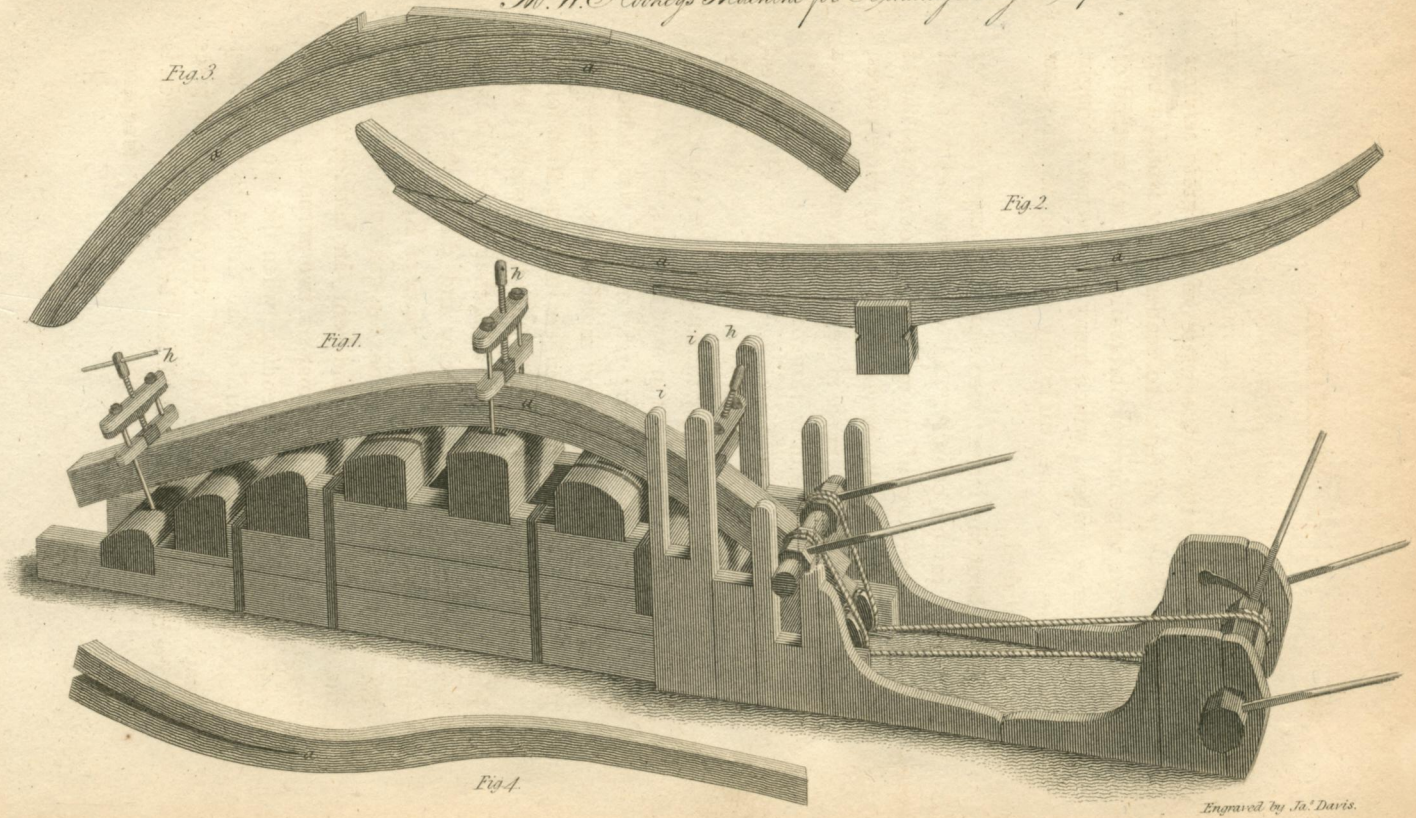
IMPRESSED with a due sense of the great services which the Society of Arts, &c. render to the world, I beg leave to make some further observations on my method of bending large timbers, which many persons have thought impossible to be done, till by my perseverance they saw it accomplished.

I have bent the largest pieces of oak timber that ever were bent in this country, and with great facility; and before the invention of my machine, recourse was had of late years, to make the curves out of two or three pieces, which of course consumed more timber, and required a considerable expense in workmanship.

My machine has been repeatedly tried in His Majesty's Dock Yard at Woolwich, and has answered every intended purpose. The floor timbers for the Black Prince, of 74 guns, have been bent in nine minutes; and a breast-hook for the Nelson, a first rate man of war, which is bolted between the upper and middle deck, made out of English oak, and also long timbers in a serpentine form.

I beg leave to make some remarks on oak timber, which I have learnt from experience, viz. that Sussex oak is the best in the world for elasticity and durability. That which grows on the South-west parts of Kent, and North East part of Hampshire, is next in quality. Previous to the timber being steamed and bent, an horizontal cut is made with a saw, which answers two purposes; it gives ease in the operation of bending; when the two parts are bolted together, the return of the timber to its former shape is more prevented. It also removes the gore piece at the butt end, when it is shaken or defective, which is frequently

Mr. Wm. Hockey's Machine for Binding Large Ship Timbers.



Drawn by Cornelius Varley.

Engraved by Ja.s Davis.

frequently the case. After the operation, the inner curved part will be found rather longer than the outer one, and forms an useful abutment in fixing the timbers at its ends.

I beg leave to subscribe myself, Sir,

Your most obedient, and very humble servant,

WILLIAM HOOKEY.

Woolwich, July 6th, 1814.

To C. TAYLOR, M. D. SEC.

Reference to Mr. HOOKEY'S *machine for bending Ship Timbers, Plate* 4.

Fig. 1, is a side view of the machine, on a scale of $\frac{1}{12}$ part of the real size, as adapted for bending midship floor-timbers, which have previously been either boiled or steamed.

The machine is divided in the middle at *a*, so as to alter its length for different sized timbers, and is kept apart, to the required length, by the suitable notches of the adjusting blocks *b* and *c*, the pressure against these being very great; hooks, one of which is shewn at *d*, are fixed on each side of the front or moveable half, to catch in holes or rings in the floor, to assist in retaining it: the other half is firmly fixed. On the adjusting blocks are placed two opposite wedges *c* and *e*, similar to those used in shoring up ships, in Mr. Sepping's mode, to support the middle of the timber; on the next blocks are iron rings, with a wooden bar through them, to keep down the timber; but screws as *h h*, are generally preferred: *g g*, *i i i i* are uprights for the windlass or capstan *k*, which may be put in

that part which best suits the timber, and when brought down by the action of the levers, the timber is secured by the screw press *h*; *b b* are iron bolts to keep the windlass down, as soon as the timber is bent.

Fig. 2, is an end view, to shew the combined action of the two windlasses and blocks. Iron plates, *m m*, are laid on the timber, to prevent the grain from rising, the ends of which are thickened with heads, *n*, fig. 3, to keep the ropes from slipping off; the ropes are united by a double hook or open link *o*, fig. 3, and then passing through the blocks *t t*, fig 3, (which are also attached to the floor by their ropes going once under the middle timber *p*, and then lashed together above by a smaller rope,) are twice wrapped round the first windlass *k*, figs. 1 and 2, and passing again through the blocks, are fastened to the second windlass *v*; by this means a great pressure is obtained. Fig. 4 shews the manner of fastening the bolts of the screws *h* to the blocks, the holes are widened as the Roman letter V, to let the screws accord with the bend of the timber, and to suit different-sized timbers; the bolts *q* have two or more loop holes at the bottom, to pin the convex nut *s* on; this nut rolls in a less concave iron plate *r*, let into the bottom of the block. Under the upper wooden bar of the screw press is a plate of iron, having a female screw in which the screw works, and its point pressing against a band of iron which encircles the lower bar, forces them asunder in action.

The machine is built upon three floor timbers, the middle one *p*, fig. 3, is thinner than the other two, to let the block ropes pass under.

Fig. 5 is Mr. Hookey's plan to make eight midship launches framed out of one piece.

Plate 5.

Plate 5, fig. 1, is another construction of the machine for bending different shaped timbers, in which the alteration is made, by disposition of the chocks or cross blocks.

Fig. 2, is a floor timber of a 74 gun-ship of one piece.

Fig. 3, a breast hook of one piece.

Fig. 4, a top timber, similar to that in the machine.

The timber is first sawn down the middle, as far as it is to be bent, as shewn by the line *a*, in the different timbers, which greatly increases the power of bending it, and permits the one part to slide over the other, so as to lessen the tear of the different parts; which are afterwards secured together by bolts passed through them, and may be still farther stiffened, by the additional pieces let into them, as shewn at fig. 2 and 3.

Fig. 1, being on a larger scale, affords an opportunity of showing the hands, pikes or levers placed in the holes in the windlasses or capstans, by the joint action of which the timbers are forced into the requisite curves, to suit which the blocks must be previously arranged, as well as the beams which support them, and which are so managed, as to form buttresses to prevent the blocks from shifting their places, in the act of bending the timber; and the whole is securely united together by iron bands, &c.

The SILVER MEDAL, *and* TWENTY GUINEAS *were this Session voted to Mr.* PETER HEDDERWICK, *of Lower East Smithfield, for a double piston Pump, yielding double the usual quantity of water from the same bore. The following Communication was received from him, an explanatory Engraving is annexed, and a working Model of the Pump is preserved in the Society's Repository.*

SIR,

I BEG leave to inform you, that I have made a considerable improvement in the working of ship's pumps, and that I wish to submit the utility of this invention to the Society of Arts, &c.

I am, Sir, respectfully,
Your obedient humble Servant,
PETER HEDDERWICK.

St. Andrew's Tavern, Lower East Smithfield, November 30th, 1813.

TO C. TAYLOR, M. D. SEC.

Reference to the Engraving of Mr. HEDDERWICK'S *double Piston Pump.* Plate 6.

Figs. 1, 2, 3, represent three methods of fitting up these pumps, but as they have nothing peculiar in them, the description will be confined to that part wherein consists the novelty of this invention.

In the pumps with double pistons hitherto made, the piston rods have been attached to one side of the pistons, thereby

thereby giving an unequal pull upon the pistons, whereas in this contrivance, they are attached to the centre of the piston, the lower piston rod passing through the centre of the upper piston.

The method of doing this is more particularly shewn in figures 4 and 5. In figure 4, K K D D is part of the piston rod of the upper piston, with two branches D D, jointed at D D to the piston F F.

G G is part of the piston rod of the lower piston, passing through the cross bar F F, which is attached to the top of the upper piston; E E, is another cross bar, by which the piston rod G G passes.

The jointed piston as here shown, is only necessary in large pumps. In smaller ones, the joint D, and the bar E E, may be dispensed with, and thus the piston rod may be all in one piece, fastened to the top of the piston box at F F, the pliancy of the rods rendering the joint at D needless.

Fig. 5, represents the top of the piston, with the cross bar F F, through which the lower piston rod G G, fig. 4, passes at I. The two valves are formed of one piece of leather in the usual manner, which is confined under the bar or cross piece F F, and is strengthened by having two plates of iron rivetted upon it, one on each valve, the valves being what are usually termed butterfly valves.

The principle will appear from the manner of working the pump, as follows:

In figure 1, A B C D H, is a handle or bent lever, upon one side, and M N L K I, a similar one on the other side of the pump, by which the power is communicated to the pistons; the lever A B C D H is moveable round the fulcrum or centre D, and the lever M N L K I round the centre

centre K; the extremities I and H are connected by a bar I H, so that when the end of the one lever A B is depressed, the other M N is raised; the straight parts C D and L K of the levers are continued to E and O, beyond their centres of motion D and K, so as to be as nearly over the centre of the bore of the pump as possible, but free of each other in the operation of working.

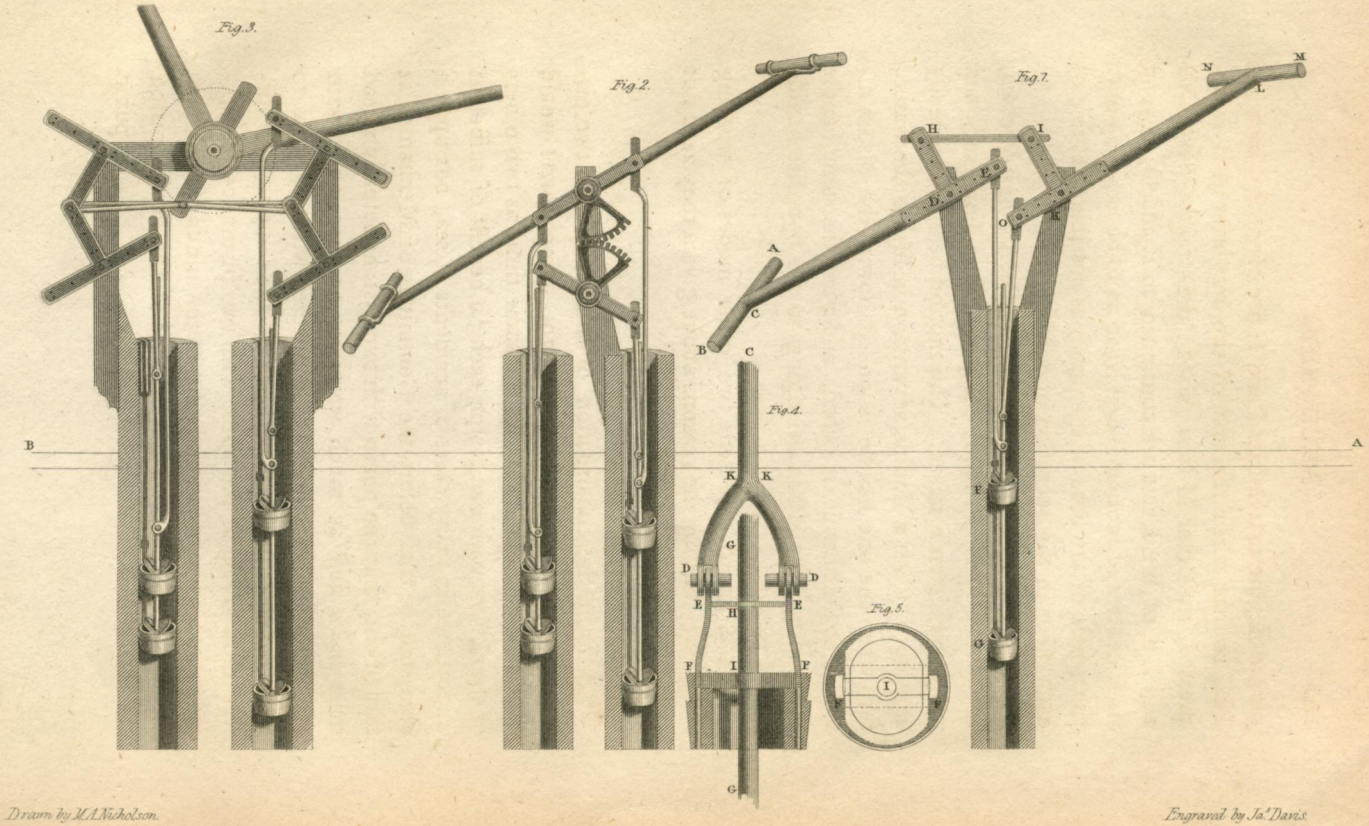
By this connexion, when the handle A B is depressed, the handle M N is raised, the piston G is depressed, and the other piston F raised. This motion being reciprocally continued, gives a double advantage in lifting the water; for, when the one handle is pulled down, the piston attached to that handle is raised, and when the same handle is raised up, the piston belonging to the opposite handle is also raised.

Figs. 2 and 3, represent two other modes of working this pump, but for the reasons above given, they need not be particularly described.

*** From the construction of this pump with two pistons, it appeared evident, that the pump barrel would raise twice as much water in the same time, as two others of equal bore with one piston each; a benefit of sufficient importance in many cases of accidents at sea, but upon a comparative trial before the Committee of Mechanics, it turned out, that the pump with two pistons actually raised *twice and a half* as much water, as another pump with one piston only, which was connected with it, so as to make equal strokes therewith, did in the same time, a difference in favour of the pump with two pistons so remarkably great, as to occasion doubts in the minds of the Committee, whether the pistons or bore of the double piston

pump

M.r Peter Kedderwick's Double Piston Pump.



Drawn by M.A Nicholson.

Engraved by Ja.s Davis.

pump might not have been more accurately formed, than in that with a single piston ; on this account, they shifted the pistons from the one barrel to the other, but, on repeating the experiment, the result was the same as before; a convincing proof that the experiment was a fair one, and in fact, the difference in the effect of the two pumps can be perfectly well accounted for, by the consideration that in the pump with a single piston, the water, after being put into motion by the action of the pump, is suddenly stopped by the change of motion during the descent of the piston, and has to be again put into motion at every stroke of the pump, to the great hinderance of the regular discharge of the water; whereas, in the pump with two pistons, the flow from it is nearly continual during its action, the one piston constantly ascending, whilst the other is descending, and the momentum of the water continuing its ascent during the change of motion in the pistons, and thus producing the very great difference in favour of the performance of the pump with two pistons ; neither does this pump ever require double the force that is applied to one with a single piston, to work it, it being much easier to continue a motion when commenced, than to renew it perpetually when interrupted as it is in the pumps with one piston only.

The SILVER MEDAL *and* TWENTY GUINEAS *were this Session voted to Mr.* CHARLES WILLIAMS, *of Hatfield-street, Black Friars Road, for a Portable Corn Mill for Family Use. The following Communication was received from him, an explanatory Engraving is annexed, and a Mill on this Construction is preserved in the Society's Repository.*

SIR,

HAVING had various applications for hand corn mills, and being convinced that nothing but stones are calculated to grind wheat, and that in every mode which has hitherto been adopted, they have always been attended with great expenses, and occupied much room, I beg leave to submit to the Society a mill, in which I have endeavoured to obviate the above inconveniences; it is composed of a pair of French burr-stones, working vertically; the running stone works against a fixed breast, which is occasionally moved to adjust the fineness of the flour by means of a regulating screw. The mill is intended to be fixed by three bolts to a post. The simplicity of its construction, the small space it occupies, and the manner of its performance combined with its cheapness, I trust will be a sufficient recommendation of it to merit the approbation of the Society.

With this mill a man may grind half a bushel of wheat in an hour. I can now manufacture them for twelve guineas

guineas each, and have no doubt of being able to make them much cheaper.

I am, Sir,

Your most obedient, humble servant,

CHARLES WILLIAMS.

No. 20, *Hatfield Street, Black Friars Road, January 29th,* 1814.

To C. TAYLOR, M. D. SEC.

Reference to the Engraving of Mr. C. WILLIAMS's *Portable Corn Mill. Plate* 7, *figs.* 1, 2, *and* 3.

A, fig. 2, the running-stone, constructed of French burr, having also a fly-wheel and a pinion upon the same axle with it, placed outside the cheeks of the frame.

I, fig. 1, shews the small pinion on the same axle with the stone A and the fly-wheel.

J, The multiplying-wheel, turning the pinion I, and thereby increasing the velocity of the stone.

K, the handle, in order to apply the power.

B, fig. 2, the moveable breast, constructed also of French burr, made to fit the running stone on one side, and cased on the other three sides with cast iron.

C, a screw to regulate the fineness of the meal, turning in a bed shewn separately at R and M, fig. 3. The side of the iron case which receives the screw, has a female or hollow screw to receive the screw at the end of Q; by this means the whole of the case is moved in a horizontal position, so that the burr-stone breast may be brought nearer to

or more remote from the cylindric running stone at pleasure. For this purpose, the cast-iron case slides upon ledges cast on the insides of the two cheeks, which support the stone and wheel work.

D, fig. 2, the screw to adjust the feed-plate, turning in a notch or bed, on the top of the moveable breast.

E, fig. 1, the feed-plate, in which the screw works, in the same manner as C, fig. 2, turning upon the bolt R S, as an axis.

F, the hopper.

H, the post to which the mill is fixed.

L, fig. 2, the brush to keep the stone from clogging.

In figure 3, Q represents the screw, with a hole through its head, to receive a lever for the purpose of turning it round, and with a neck and shoulders upon each side of it, to turn in the semicircular notch M, of the bar R.

This bar has its ends bent at right angles, and fitted to grooves in the cheeks of the mill, parts of which are shewn at N, O, so as not to shake, and the whole is bound together by the rod P, which is screwed at each end, with a separate nut to each screw.

The frame of the mill is formed of cast-iron plates.

Directions for working the Mill.

The mill is intended to be firmly fixed to a post, by means of two or three bolts. The slide in the hopper must be put down whilst filling it. On beginning to grind, it must be adjusted so that the wheat may go regularly in. If the mill does not grind fast enough, the small screw in front must be unscrewed till it does, which may be known by

Mr. B.s Williams's Portable Corn Mill.

Fig.1.

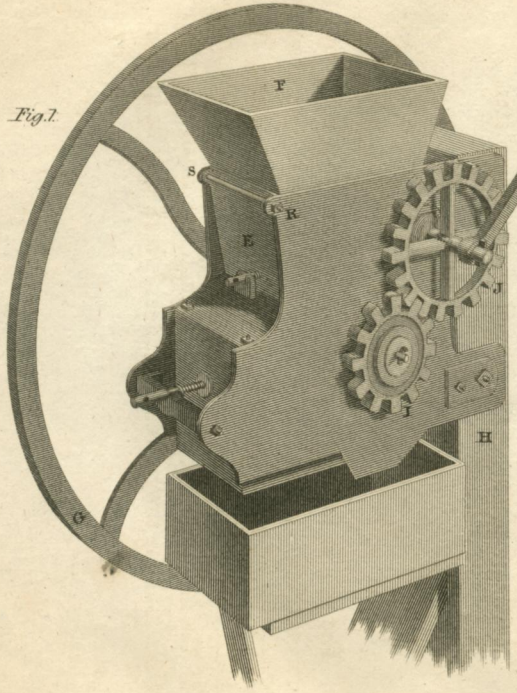


Fig.2.

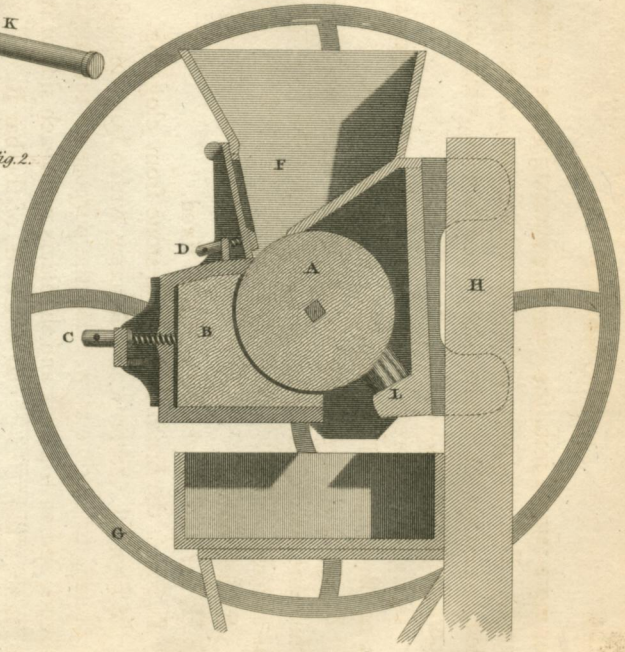
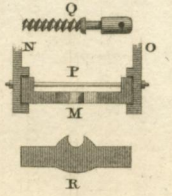


Fig.3.



Drawn by M.A.Nicholson.

Engraved by Ja.s Davis.

by its going harder; if it takes the corn too fast, so as to go too heavy, screw the same screw farther in: by this regulation any power applied may be suited. To make it grind finer, unscrew the large screw, if coarser the reverse.

*** A number of satisfactory experiments were made in the presence of the Committee of Mechanics, respecting the power and effect of this mill; and it appeared that it is free from the defect of steel mills, which rather cut than grind the corn, the wheat here being ground down in a similar way to that of the large burr-stones in common mills, and producing a clean flat bran.

The SILVER MEDAL *was this Session voted to Mr.* JOHN WOODALL, *of London Wall, for a Wind-up Bedstead, for sick or lame Persons, by which their Position can be easily altered without occasioning Pain or Fatigue. The following Communication was received from him; an explanatory Engraving is annexed, and a Model is preserved in the Society's Repository.*

SIR,

PERMIT me to lay before the Society of Arts, &c. for their inspection, a model of an improved wind-up bedstead, which is my own invention, and I trust will meet with their approbation. I had the honour to lay before

them about twenty years ago, a model of a different one, which worked with a quadrant rack on each side, and which was greatly approved at the Sick and Hurt Office. I made near three hundred of them for Government and the following hospitals, namely, the Smallpox, St. Thomas's, the London, St. George's, and the Westminster Infirmary, besides a number for private families.

The invention was also highly approved by the Royal College of Surgeons in London, and the model remains in their Museum, in Lincoln's-Inn-Fields, and I had the honour to receive their thanks for it, on January 6th, 1812, under the signature of their Secretary, Mr. Edmund Belfour. The invention now sent is much superior in construction to those above mentioned, as the present model works smoothly without any jerks, and by one rack only, which enables one attendant to raise or depress the bed at pleasure, and it remains firm in any position in which it is placed. I could furnish bedsteads on this construction, for about thirty-six shillings each, and an old bed may be easily altered to this plan. If necessary, I could by the same movement, lower the foot part of the bed, so as to make the bed answer the purposes of a chair.

I am, Sir,

Your very humble Servant,

JOHN WOODALL.

London Wall, March 1st, 1814.

To C. TAYLOR, M. D. SEC.

CERTIFICATES.

THIS is to certify, that the wind-up bedstead, according to the model recently presented to the Society, for the Encouragement of Arts, &c. made for the use of this hospital, appears upon trial, well calculated for its intended purposes. Signed,

WILLIAM NASH, Steward.

St. Thomas's Hospital, April 14th, 1814.

CERTIFICATES in favor of Mr. WOODALL's improved bedstead, were also received from Mr. G. CHANDLER, Mr. JOHN BIRCH, and Mr. HENRY CLINE, Jun.

Mr. BRIGGS, Mr. DAWSON, and Mr. TOBIN, Surgeons, who were present on the examination of the bedstead by the Society's Committee of Mechanics, stated, that they had not seen any contrivance equal to the present for its intended purpose.

*** Mr. WOODALL the inventor stated, that Mr. NASH's Certificate comprized the general opinion of the Surgeons at that Hospital, and that an experiment was made there of winding up two persons, also one hundred pounds extra weight at the same time, which was performed with ease.

Reference to the Engraving of Mr. J. WOODALL's *Improved Bedstead. Plate* 8.

Figure 1, is a view of the bedstead; A B C D is an iron frame hinged to the rails, forming the sides of the bedstead

at A and D; the ends A D and B C of this frame being bent, in order to permit the middle of the ticking to hang at liberty.

E, the rack, being the arch of a circle, toothed on its edge, and fastened to the middle of the ends of the iron frame B C and A D, the line joining the centres A and D, being considered the axis of this arch.

F F, an endless screw fitted into the teeth of the rack E, and supported at the points F F, by two opposite pivots acting in holes, one in the end next to the screw, and one at the other end or foot of the bedstead, by a piece depending from the rail.

G the handle, which being turned either way, will elevate or depress the frame A B C D, in the degree required; as is evident from this description; and in this way, a motion equable, smooth, and easy to the patient is obtained, and with the least possible labour to the nurse, and the position of the frame is firmly secured by the resistance opposed by the endless screw, to the teeth of the arch acting in it; and this, without the help of a click or ratchet, or any other noisy mode of retaining the frame in its position.

Mr. J. Woodall's Wind-up Bedstead.

Fig. 1.

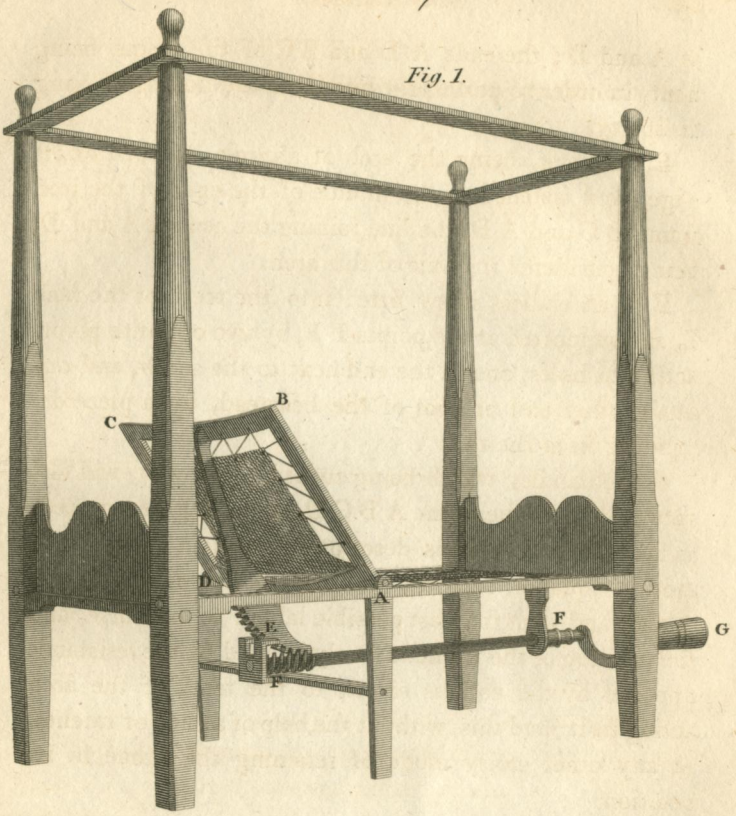
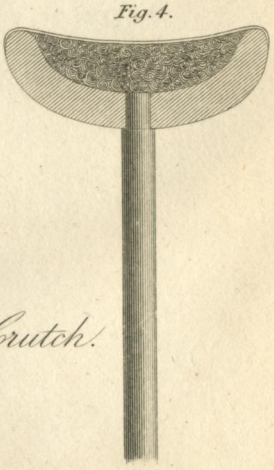


Fig. 2.

Fig. 3.

Fig. 4.



Mr. J. Laurence's Crutch.

M.A. Nicholson delin.

G. Gladwin sculp.

The THANKS *of the Society were this Session voted to* JOHN LAURENCE, ESQ., *of the London Assurance House, for an Improved Pair of Crutches for Lame Persons. The following Communication was received from him, an Explanatory Engraving is anneed, and the Crutches are placed in the Society's Repository.*

SIR,

THE crutches which I have laid before the Society, are sent with a view to the general benefit of persons who have occasion for such assistance, and will be found to possess advantages in giving considerably more ease to the shoulders and hands of the invalid, than those in common use.

With respect to the crutches, it is not my intention to claim any reward; I only beg they may be presented to the Society in my name, which the friend from whom I have received them, has authorized me to do.

I do not know the inventor or maker of them, they were procured for my friend by Mr. Miller, the late surgeon of Greenwich hospital, about four years since.

With every good wish for the prosperity of the Society,

I am, Sir,

Your most obedient Servant,

JOHN LAURENCE.

London Assurance House, March 23d, 1814.

To C. TAYLOR, M.D. SEC.

Reference to the Description of the Improved Crutch, presented to the Society of Arts, &c. &c. by Mr. LAURENCE. *Plate* 8, *figs.* 2, 3, *and* 4.

Fig. 2 represents the whole crutch, with its moveable handle *a*, in which the peculiar merit of this invention consists; this is shewn on a larger scale at fig. 3, where the handle with its screw is seen, by which it can be fixed at any height or position required by the patient, who is thus enabled to hold the crutch with far greater ease than in the usual manner of constructing it without such handles.

Fig. 4 shews the manner in which the head of the crutch is formed, so as to produce an elastic support to the patient, and thus break off the effect of the shocks occasioned by striking the end of the crutch upon the ground in walking with it; this is done by making the wood in the form of a crescent, across which, bands of linen girth web are stretched and secured firmly at each end, and the vacancy underneath them being filled with a cushion of twisted and baked horsehair: the whole, when covered with plush, velvet, &c. nailed over it, forms a very pleasant support to the patient: the lower end of the crutch has a turned conical piece of wood affixed to it, which may be renewed when worn away or lengthened to suit the height of the patient.

The

The SILVER MEDAL *was this Session voted to Mr.* L. BYRON, *of Princes Square, St. Georges East, for a Sinical Octant for taking Altitudes, &c. The following Communication was received from him, an Explanatory Engraving is annexed, and the Instrument preserved in the Society's Repository.*

SIR,

BEING a teacher of navigation and lunar observations, I beg leave to present, under the patronage of the Society of Arts, &c. to mariners and the public, my sinical octant, an instrument truly useful to the sailor, rendering him capable, by a single movement, to produce the answer to any question that may be proposed in trigonometry, plain, Mercator's, middle latitude, or parallel sailing; also to determine the bearing and distance to any known place almost instantaneously. In short, it comprizes all the properties of the tables of latitude and departure, either in points or degrees, and qualifies the sailor to keep the ship's account completely, without the help of scales or tables.

I am, Sir,

Your humble Servant,

L. BYRON.

15, *Princes sq. St. George's, East,*
November 10*th*, 1813.

To C. TAYLOR, M.D. SEC.

Reference to the Engraving of Mr. L. BYRON's *Sinical Octant, Plate* 9, *figs.* 1 *and* 2.

This instrument consists of a flat, angular piece of hard wood B A C, of an equal thickness throughout, having upon its face either lines and figures as below described, cut into the wood itself, or printed upon paper from an engraved copper plate, and cemented upon its surface, which must be afterwards varnished; and of a moveable limb A D, turning upon a pin A, screwed into two brass plates rivetted into the piece B A C as an axis: this limb is made bevelling towards its fiducial edge, the better to read off the divisions.

The advantages of this contrivance consist in its simplicity, its easy adaptation to the uses of the mariner, and its very great cheapness; in fact, it might be very readily constructed by any one in the least degree acquainted with geometry, for his own use, by merely drawing the lines upon paper, and cementing them upon the board and limb. Its merit, however, will be better understood, by a description of its geometrical construction, and a few examples of its uses.

This octant is the sector of a circle B A C. The vertical angle A contains 45°, being the eighth part of a circle, as its name implies, or of 360°.

The leg A B is graduated into 90 equal parts, which may represent miles, leagues, &c.; through the points of division lines are drawn, perpendicular to A B, to meet the opposite side A C, or the arc B C; and for the facility of numbering or reckoning, every 10th perpendicular line from A is made stronger than the intermediate ones.

Another

Another series of lines are drawn at the same distances, parallel to A B, to meet the leg A C, or the arc B C, and every 10th line from A B is also made stronger than the intermediate 9 lines for the reason before given.

The arc B C is graduated into 45°. A moveable limb or rule A D, is attached at A to the instrument, and moveable round the same point A; the thin edge A D of the rule is graduated into a scale, the same as the side A B of the octant.

By this construction, a right angled triangle may be formed in any given proportion, and to any extent that the limits of the instrument will admit of.

The scale A B is numbered from A to B, and the scales on every 10th perpendicular to A B are numbered from the line A B towards A C. The arc B C is numbered from B towards C.

In forming any right angled triangle, it is to be understood that there must always be two given parts, and that a side of the triangle must always be one of these parts, conformable to the rules of plain trigonometry. The parts that are thus given, may be either two sides, or one side and an angle. These two sides may either be the two legs, or the hypothenuse and one of the legs When an angle is one of the given parts, it must be concerned either with the hypothenuse, or with one of the legs.

The most usual data is an angle and the hypothenuse; though the other data forming the different cases, may be useful upon certain occasions.

In navigation, any distance measured upon the meridian between any two points or places, is called the difference of latitude of these points or places. But if a vessel do not sail directly north or south, but makes the same angle with

with every meridian she comes to, whether towards the north or towards the south, the distance from the place she sailed from, and to the place she arrives at, is simply called her distance: and the angle which she forms with the meridians, is called her course. The perpendicular distance between the point from which she arrives, and the first meridian from which she sailed, is called her departure; and the distance intercepted by this perpendicular on the original or first meridian, to the place she set sail from on the same meridian, is her difference of latitude; and thus, by only giving particular names to the parts of the triangle, instead of the general ones, as the course for the given angle, and the distance run for the hypothenuse; one of the legs is her departure, which is always opposite to the course, and the other her difference of latitude, which is one of the legs that form the course.

If it happen that the course contains a greater angle than 45°, it must be subtracted from 90°, so that, in this case, her difference of latitude will be opposite the given angle, instead of her departure; that is, opposite the angle made at A, by the moveable rule A D and the side A B of the octant.

The use of this instrument will be best explained by an example or two.

Example I.

Suppose the course to be 10°, and the distance near 80 miles, the departure and difference of latitude are required.

Bring the fiducial edge of the limb upon the course 10°: observe which of the perpendiculars opposite the angle A is cut by the moveable limb; then the departure will be found

found upon that perpendicular, to be 14 miles from the line A B to the point 80, upon the edge of the rule A D; and the difference of latitude to be 78 and about two-thirds, upon the side A B of the octant from A to the point cut by the perpendicular from 80, or the nearest within 80 in the edge A D of the limb.

Example II.

Suppose the course to be 75°, and the difference of latitude 33 miles; the distance run and departure are required.

Subtract 75° from 90°, and there remains 15°, which gives the angle opposite the difference of latitude; bring the fiducial edge of the limb A D, upon 15° on the arc B C, observe the point on the edge of the limb A D, cut by that perpendicular from A B, which just contains 33 miles: and the distance intercepted between A and this perpendicular, on the side A B of the octant, is the departure as required.

Example III.

Suppose the course to be 62°, and the departure 74 miles; the distance run and the difference of latitude are required.

Subtract 62° from 90°, and there remains 28°, for the angle opposite the difference of latitude. Bring the fiducial edge to 28°, then, from 74 on the side A B, observe the length of the perpendicular, or the next nearest perpendicular towards the centre A, from A B, to the edge A D,

of

of the limb; which will give 40 for the difference of latitude.

Example IV.

Suppose the difference of latitude to be 68 miles, and the departure 28 miles, the course and distance are required.

Take the point 68 upon the side A B, then upon the perpendicular from 68 number of 28 miles; bring the fiducial edge to the point 28 on the perpendicular, then the distance $73\frac{1}{2}$ intercepted upon the fiducial edge of A D, from A, to the point 28 on the perpendicular, is the distance run; and the angle $22^{\circ}\frac{1}{2}$ contained by the fiducial edge, and the side A B of the octant is the course. In addition to the divisions above mentioned, there is likewise an arc divided into four principal divisions, and these again subdivided into halves and quarters, answerable to the points of the mariner's compass in the octant, or eighth part of a circle, which leaves it in the mariner's power either to take points or degrees, according to the accuracy of the operation required.

Mr. L. Byron's Sinical Octant.

Pl. IX.

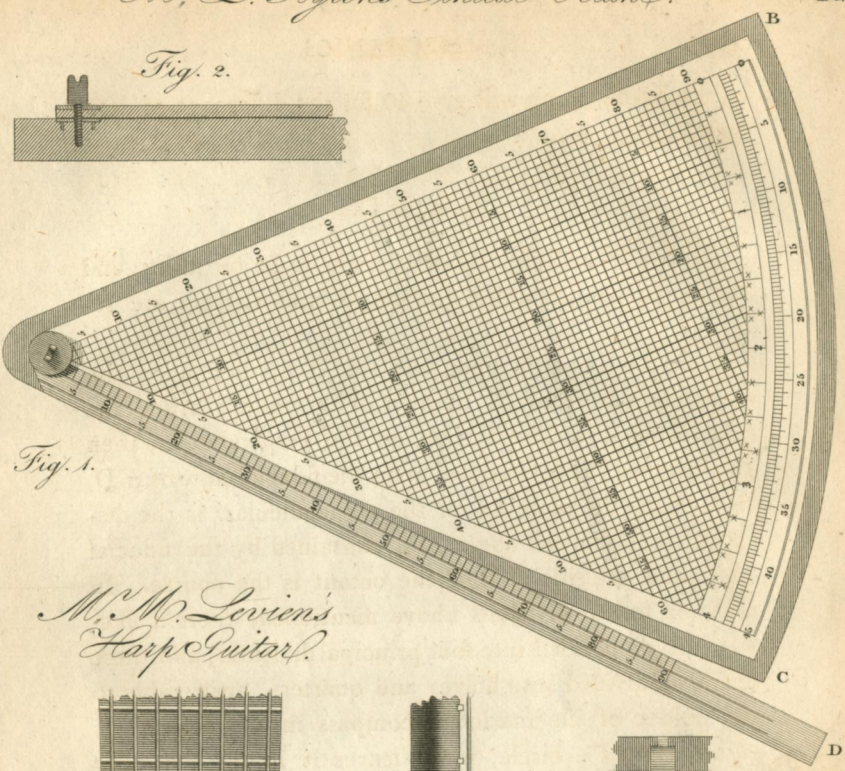


Fig. 1.

Fig. 2.

Mr. M. Levien's Harp Guitar.

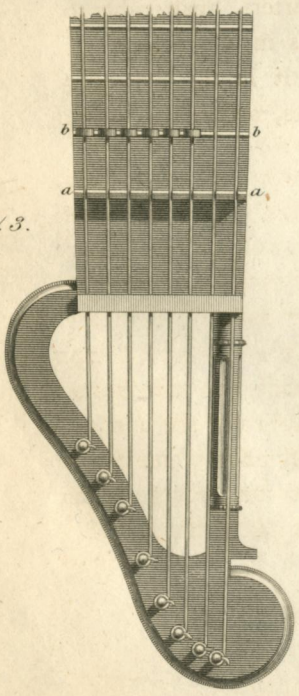


Fig. 3.

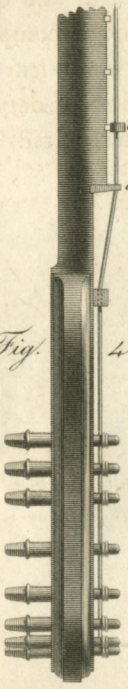


Fig. 4.

Fig. 6.

Fig. 7.

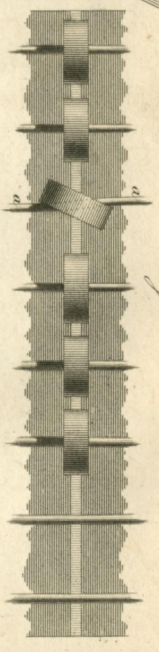


Fig. 5.

M.A. Nicholson delin.

J. Bacon sculp.
23 Holborn Hill.

TEN GUINEAS *were this Session voted to Mr.* M. LEVIEN, *Pleasant-Row, Pentonville, for his Improvements on the Harp-Guitar, which enable the Performer to play in all the various Keys with Ease, Effect, and Facility. The following Communication was received from him, an explanatory Engraving is annexed, and the Instrument preserved in the Society's Repository.*

SIR,

I BEG leave to lay before the Society of Arts, &c. an improved harp-guitar, the tone of which is similar to the harp, and on a construction which enables the performer to accompany the voice with greater effect, and execute in all the various keys with as much ease as in the general key of C; which prevents the necessity of transposition, and renders facility of performance upon it, much sooner acquired, than on any other guitar, lute, or lyre.

As it may be necessary to give some explanation respecting the improvement of the above instrument, I beg leave to state the nature of, and the mode of execution on the harp-guitar now in use. They are made some with six, and some with seven strings, and are tuned in C; the music for them is never written but in three different keys, namely, the key of C, which is the most general, having neither flat nor sharp. The key of F, which has one flat, and the key of G, with one sharp; all other keys are so extremely difficult, requiring so much labour and cross-fingering that they are never attempted even by a master.

It frequently happens, that ladies meet with songs, &c. which

which they wish to play upon the guitar, but being written probably for the piano-forte, and in some difficult key they are deprived of that pleasure unless they are transposed into one of the above familiar keys, which must take up time, is troublesome, and the rule of transposition perhaps not understood.

I have, therefore, invented brass-stops, which being fixed upon the first fret, obviate all the difficulties abovementioned; for, by turning the stops agreeably to the key intended to be played in, the performer will be enabled to execute with as much facility as in the general key of C.

The turning these stops at pleasure for the different keys is also so simple, that any lady who plays the guitar on the common principle, may be taught the improvement upon my instrument in one lesson.

I beg leave to observe, that this is an improvement long wished for, and I feel anxious to give it publicity; and shall, therefore, consider myself highly honoured, and very much obliged by the Society's inspection and decision upon it.

I am, Sir,
Your most obedient, humble servant,
M. LEVIEN.

No 8, *Pleasant-Row, Pentonville,*
March 29, 1814.

To C. Taylor, M. D. Sec.

CERTIFICATES.

DEAR SIR,

I HAVE maturely deliberated upon your explanation respecting the difference between the *old French guitar*, and your instrument called a harp-guitar. The improvements in the latter are so obvious, that I feel no hesitation in congratulating the admirers of that instrument upon the advantages which it possesses of playing in eight different keys, where the original played but in three, and also producing more notes, with less stopping or fingering than any guitar heretofore produced. I have no doubt but that the instrument, in its present improved state, needs nothing more than publicity to bring it into general use, as it far surpasses all others in point of compass, facility of performance, &c.; and that it may answer your most sanguine expectations, in point of success, is the sincere wish of,

Dear Sir,

Your's truly,

JOHN WHITAKER.

St. Paul's Church-Yard,
April 20, 1814.

To M. LEVIEN, &c.

*** Mr. FLIGHT, organ-builder, and Messrs. WHETSTONES, who attended the Committee of mechanics, concurred in opinion, that this is a new and decided improvement of the instrument.

Reference

Reference to the Engravings of Mr. M. LEVIEN'S *improved Harp-Guitar, Plate* 9, *Figs.* 3, 4, 5, 6, *and* 7.

This improvement consists in an appendage to the finger board, by which, any of the strings can be raised or lowered half a tone, so as to introduce such flats or sharps as are necessary, in order to perform such music as is ordinarily met with, without the necessity of previously transposing it into the keys of C, G, or F, as is the case with guitars in general.

This is effected, by placing across the first fret of the finger-board a series of metal loops or stops, through which the strings pass, the holes in the loops being widened so as to permit the strings to vibrate therein unimpeded. These loops being screwed into the finger board can be turned so as to compress the string on each side in the manner frequently done on pedal harps, and thereby to raise the tone of the string half a note higher, thus introducing those sharps, &c. which are necessary to the performance of the music, without the necessity of cross-fingering, the only method of producing them hitherto used, and the great difficulty of doing which is sufficiently known.

Fig. 3, represents the head of the improved guitar, and part of the finger-board; *a, a,* the nut, and *b, b,* the metal loops arranged across, or in place of the first fret; fig. 4, is a side view of these parts; fig. 5, is an enlarged view of that part of the finger-board containing the first fret, with the loops screwed into it of their full size; one of the loops, *a, a,* is here represented as being turned, and acting upon the string so as to raise its tone half a note higher; and

and fig. 6 shews one of the loops, with its screwed tail or stem and its hole widened as described above, but which more evidently appears in the section of the hole, fig. 7, the opposite sides of it being rounded off, so as not to gall or injure the gut or silk string, by pressing against it, when turned.

The loops are turned by means of a slit made across the handle of the key, used in turning the pins to put the guitar into tune.

The GOLD ISIS MEDAL *was this Session voted to Mr.* P. NICHOLSON, *of Oxford Street, for a new and correct Method of squaring a Hand Rail round the Winders of a Stair Case, so as to be got out of the thinnest Plank possible, and to cut it out to the greatest Advantage, in order to match the Grain of the Wood. The following Communications were received from him, explanatory Engravings are annexed, and Models and Drawings are placed in the Society's Repository.*

SIR,

I BEG leave to lay before the Society of Arts, &c. an invention of mine, which will be found simple in its principle, and important in its application. It consists in a new and correct method of squaring hand-rails round the winders of stair-cases, and depends upon the section of a cylinder cut through any three given points on its surface.

By the application of this principle, the quantity of stuff used in the construction of hand-rails, may be very considerably reduced. It will not only enable the work-

man to cut out the plank in the most advantageous manner for matching the grain of the wood, but will likewise allow of his using the thinnest stuff possible. It is also useful in all works where both plan and elevation are circular, particularly where a cylindric wall is excavated by cylindric openings, and in the construction of archivaults for finishing such windows. Its universality is such, that it may be applied to the angular ribs of cylindro-cylindric groins (such as those in the entry to Somerset House) to spherical niches in circular walls, and to all groins that are circular upon the plan.

Its advantages are incalculable in all works of double curvature, owing to the great facility with which the principle is applied, and the immense saving of time, as well as material attending its application. It entirely supersedes the use of the centre or cylinder, which has hitherto been used to fit the work upon by way of trial, and will enable the mechanic to bring the work to its form in much less time than he has usually employed in preparing the centre.

The use of this principle is not confined to wood-work, but may be employed in all kinds of masonry where works of double curvature occur.

To enumerate the particular advantages of this discovery, would oblige me to trespass too long on your time, which I do not conceive necessary, as the inspection of the models will render these advantages sufficiently apparent.

I am, Sir,

Your obedient humble Servant,

PETER NICHOLSON.

No. 404, *Oxford Street, Nov.* 15*th*, 1813.

To C. Taylor, M. D. Sec.

Society for the Encouragement of Arts, &c.

Hand

HAND-RAILING *is the Art of forming Hand-rails by Moulds, according to Geometrical Rules.*

The principles upon which this art depend, are, that of cutting a right prism through any three given points in space, and that of forming a developement of any portion of the surface of the prism.

In order to illustrate this, let the interior surface of the surrounding wall be that of an entire cylinder, and let the breadth of the steps be divided into the frustums of equal and similar sectors, and let the heights be all equal, as is universally the case; then, if an interior cylindric surface be erected concentric with the wall, and the ends of the steps or surfaces on which we tread, and the planes of the risers tending to the axis, be supposed to meet the interior cylindric surface, it is evident that if the portion of the intercepted surface contained between the indented line formed by the ends of the steps, and the circumferent line at the base be developed or stretched out, all the points of the indented line formed by the outward or salient angles, will be in the same straight line, and all the points formed by the inward or re-entrant angles will be in another straight line. It is also evident, that this will not only be the case with cylinders, but with cylindroids, and every other description of prisms; that is, the points of the developement of the indented line will always have such a position, that two straight lines parallel to each other, may be drawn through the whole number of points.

The points of concourse of the salient angles, are called the nosings of the steps.

The line drawn through all the nosings of the steps, is called the line of the nosings.

Now let the portion of the cylinder before uncovered, be again enveloped, the developement in this state becomes an envelope, and the line of nosings becomes an uniform helix, which would be the form of the rail for such a stair.

In this case, it would be easy to execute the rail to any length we please, in equal portions succeeding each other; for, as the curvature of the helical line is every where the same, the same moulds which are used in the formation of one piece, would serve for every succeeding piece.

The steps placed around the circular part are termed winders; in these the risers tend to the axis of the cylinder.

Steps which have their treads the same breadth, are termed flyers; in these the risers are all parallel.

Very few stair-cases are however entirely circular, but those of the semicircular form with winders in the semicircle, and flyers below and above, are very numerous; in such the line of nosings would be crooked, and would form an angle at the junction of the flyers and the winders, and that round the semicircle would be an helix, consisting of half a revolution.

In the developement of the steps, the line of nosings would consist of three straight lines, the two straight lines through the nosings of the flyers, would be parallel to each other, and each extremity of the middle one would join one extremity of each of the other two; the angles are commonly taken away by introducing a curve in their places.

A hand-rail, however, is not a mere helical line, but a solid, which may be contained between two concentric cylindric surfaces, or concentric prismatic surfaces. The principles are the same, whatever be the form of the plan. A solid erected upon any plan, is called a prism; a cylinder is therefore a round prism; and a cylindroid an elliptic prism.

prism. A hand-rail may stand upon a circular base, or partly circular and partly straight, or upon an entire elliptic base. In the construction of hand-rails, all prisms are excluded which consist of plain surfaces, or which is the same thing, where the sides of the plan consist entirely of straight lines, as in such cases, the rails themselves are either straight, or partly curved and partly straight upon the top and lower sides only, the sides being in vertical planes.

I shall therefore confine myself to prisms that stand upon a circular base, or upon an elliptic base, or upon a base that is partly circular and partly straight, or, lastly, upon a base that is partly elliptical and partly straight. These two last may be said to have compounded bases or plans, and the former two simple bases or plans; I shall call such a prism a curved prism.

The plan of any curved prism is understood to be of the same breadth, and consequently the solid erected thereon will be every where of the same thickness. The prism may therefore be a hollow cylinder, or a hollow cylindroid, or a concave body partly cylindric and partly straight; the latter may be open on one side, and may have the four planes which join the curved surfaces parallel to each other, and tangent to each of the cylindric surfaces.

Let us therefore suppose such a prism as that last mentioned, and let us suppose it to be cut entirely through its vertical surfaces, in such a manner that any point in the surface of division may coincide with a straight line every where perpendicular to the external prismatic surface, then, every such line will be parallel to the plane of its base, and those lines in the cylindrical part of the prism will tend to the axis. Now it is evident, that the cut or dividing

surface will not be a plane, but will wind or twist between the cylindric surfaces. It is also evident, that the cut may pass through a line drawn in any manner we please, in one of the prismatic surfaces; or, that the developement of this line may have any degree of curvature in the whole length, or in any portion of the length, or may even be a straight line. One of those being supposed to be the case, let the upper part of the prism be taken away, then the upper surface of its remaining part will be brought to view; let a line be drawn on the exterior surface, parallel to the arris, and another on the concave side, parallel to its arris; and let another cut or dividing surface be made to pass through the two lines thus drawn, and let the upper part be removed by this division, then the part thus removed will form a solid helix or kind of half screw which may be either uniform in its upper and lower surfaces, or have any degree of curvature in any part that may be required, according to the developement before mentioned. This is the form of the rail for such a stair, but to form the solid helix, without cutting it from a hollow curved prism, is the thing required to be done in hand-railing.

Now, seeing that two of its sides are actually cylindrical and would be vertical if placed in position; and that the other two winding surfaces may be formed to any developement we please; let us therefore take any determinate portion of the helical solid as a quarter of a revolution, or perhaps something more, as occasion may require, and I shall endeavour to form such a portion or wreath out of a thin plank, instead of cutting it from a solid curved prism. Before this can be done, it is necessary to understand the principle of cutting a prism through any three fixed points

points in space, by a plane passing through these points; the points may be in the surface of the prism itself, and may be either all in the concave side, or all in the convex side; or partly in the concave side, and partly in the convex side;—That such a supposition is possible will readily appear, since any three points are always in the same plane; and, therefore, the plane may cut the prism through any three given points.

The three points through which the section is cut, are said to be given when the seats are given on the plane of the base of the prism, which plane is understood to be at right angles to the axis of the prism, and when the distances or heights from the seats to the points themselves, are given.

It is always to be understood, that the three seats are not in a straight line, and consequently the three points themselves not in a straight line.

The seat of a point in space on any plane, is that point in the plane, where a perpendicular drawn through the point in space, cuts the plane.

This being established, I shall now show the best means of applying these principles to hand-railing.

In the helical solid, the winding surface connecting the two prismatic surfaces, was defined to be of such a property, as to coincide with a straight line perpendicular to the exterior prismatic surface, and, consequently, if the axis of the curved prism be perpendicular to the horizon, every such line will be parallel to the base; now, let the seats of three such lines be given on the plan, viz. let each extreme boundary be one, and let another be taken in the convex side passing through the point, which would give the middle of the developement of the said side of the

plan; the three seats would be terminated by the convex and concave sides of the plan, and will always be perpendicular to the convex side, and equal in length to each other. Let us call the three level lines, of which their seats are given, the lines of support; let a plane be laid on the three lines of support, the plane will either rest upon three points, or upon one of the said lines and two points; it is evident, that the points which come in contact with the plane, will be at one extremity of each line of support; let each of these points which come in contact with the plane thus posited, be called a resting point. The three resting points are the three points in space, through which the plane is supposed to pass, that cuts the curved prism.

Now, because that each line of support has two extremities, there will be six extreme points in all, but as only three can be resting points, unless the plane coincides with one of the lines of support, it will be proper to shew, which three of the six are the resting points. Let the plane, thus laid upon some three extremities of the lines of support, be continued to intersect the base of the curved prism, then the nearest extremity of the seat of any line of support to the intersecting line, is the seat of the resting point of that line.

For this purpose, let a developement of the convex side of the rail be made according to the plan and rise of the steps. The part of this developement that is made to bend round the convex or concave cylindric surface of the helical portion or wreath, is called a falling mould, which is supposed to be brought to an equal breadth throughout its length. Only one falling mould is used in the construction of hand-rails. Let, therefore, the falling mould for the convex side be constructed, and let two straight lines

lines be drawn from the ends of the upper edge of that part of the falling mould corresponding to the ends of the wreath, perpendicular to the base of the whole developement; also, let another intermediate line be drawn parallel to the other two, so as to bisect the part of the base intercepted by the said two parallels: the three parallels will thus give the heights of the three resting points, the shortest height is at one extreme, and the longest at the other. Suppose now, the shortest of these three heights taken from each of the three, and the remainders taken as heights, instead of the whole, then the height of the first resting point will be nothing, and will therefore coincide with its seat; then, if the middle height be less than half the length of the remaining height, the seats of the resting points will be the first and second extremities of the first and second lines of support taken on the convex side, and the extremity of the third on the concave side. The first resting point is a point in the intersection of the plane of the base, with the inclined plane.

The process is now completely reduced to that of finding the section of a prism through three given points, which suppose to be done, and the plane of section will touch the supposed wreath, at the resting points of each line of support, without cutting the wreath at any such line—then, the three lines of support will be on the same side of the plane, viz. on the under side. Let us suppose now, another section taken below, and parallel to the former, so that the wreath may be just contained between these parallel sections, or planes; the distance between the two sections, will represent the thickness of the plank.

The section of the prism through its vertical surfaces, is called the rake, or the rake of the plan; and a mould being cut to the rake, is called the face-mould.

The

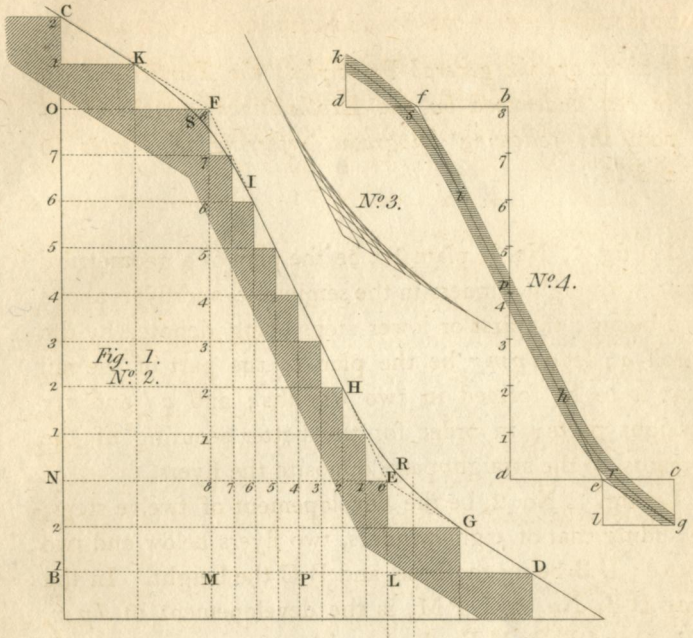
The above are the general Principles; the Particulars will be best understood by the Explanations which accompany the following Diagrams, referring to Plates 10 *and* 11.

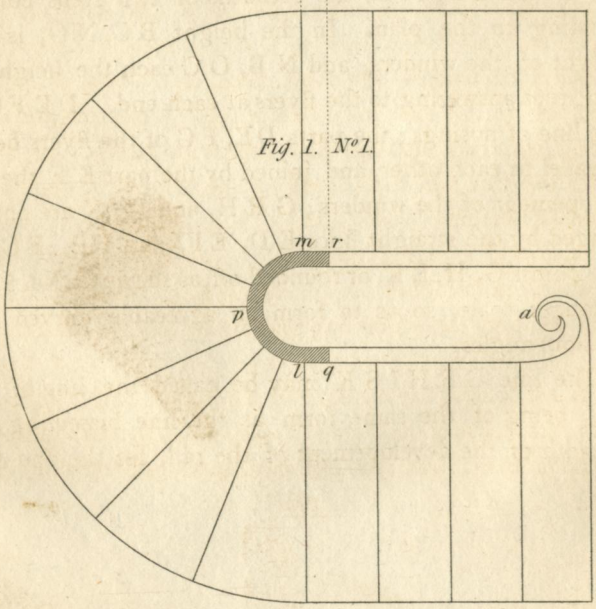
Let fig. 1, No. I, plate 10, be the plan of a geometrical stair, with eight winders in the semicircle, and flyers above and below; the first or lower steps being denoted by the scroll *a*; let *q l p m r* be the plan of the part of the rail that is to be formed in two wreaths; and *q l* and *m r* straight parts; in order for the better securing of the wreaths, to the straight parts opposite the flyers.

Let fig. 1, No. 2, be the developement of twelve steps, including that of eight winders, two flyers below and two above; D B being the base, and B C the height. In the base D B, No. 2, L P M, is the developement of *l p m*, No. 1. and L D, M B, the breadths of two steps corresponding to the plan. In the height B C, N O, is the height of the winders, and N B, O C each the height of two steps answering to the flyers at each end. D E F C is the line of nosings; the parts D E, F C of the flyers being parallel to each other, and joined by the part E F the developement of the winders; G R H, and I S K are curves tanged by the straight lines E D, E F, and F E, F C, at the points G, H, I, K, or rounded off, as shewn at No. 3, on a longer scale, so as to form an agreeable curved line without angles.

The line G R H I S K may be called the line of the rail, being of the same form as the line bissecting the breadth of the developement of the rail, for the one may be

Mr. P. Nicholson's Method of Squaring Hand Rails.





Drawn by M. A. Nicholson. Engraved by J. B. Taylor.

be supposed to be every where of the same height from that of the other; and therefore, the line G R H I S K, may be conceived to be the developement of the rail.

No. 3 shows the manner of drawing the tanged curves G R H, and I S K; No. 2 the upper one I S K, being the same as the lower one G R H, but inverted.

No. 2 shows more lines than are wanted in practice, in order to shew the connection between the developement of the steps, and the developement of the line of the rail. But, as the developement of the line of the rail is all that is wanted, make *a b*, No. 4, equal to the height of the winders, draw *a c* and *b d*, at right angles each with *a b*; make *a e* and *b f* each equal to the developement of *l p* or *p m*, No. 1; make *e c*, and *f d*, the breadth of a step; draw *c g* and *d k* parallel to *a b*; make *c g* and *d k* each equal to the height of a step; join *e g*, *f k*, and *e f*; make *e h*, equal to *e g*, and *f i* equal to *f k*, and draw the tanged curves *g r h* and *i s k* as before; then *g r h i s k* will be the line of the rail, as in No. 2; for *e f* will be obtained, equal to E F, No. 2; and *e l g* will be the section of a flyer at the lower end, and *f d k* the section of a flyer at the upper end. The breadth of the falling mould, in common cases, is about two inches, therefore, two lines being drawn parallel to the line of the rail, each at an inch distance from it, gives the complete falling mould for both wreaths. The two parts of the falling mould as divided by *a b*, are equal and similar to each other, and would therefore coincide if applied together.

Let fig. 1, No. 1, plate 11, be an enlarged plan of the rail, of double dimensions to No. 1, plate 10, in order that the moulds may be more exactly obtained, and the construction

tion more clearly seen. Let A B C D E F G, fig. 1, No. 3 be the plan of the part of the wreath to be formed, A G being the seat of the line of support at the lowest part, and D E that at the highest part; then A is the seat of the resting point at the lowest end, and E that at the highest end. Take the point C, between A and D, so that C, in the developement of the line A B C D, may divide the said developement into two equal parts.

Let A B C D, No. 2, be the developement of the curve A B C D, No. 3.; the parts A B, B C, C D, being the respective developements of A B, B C, C D, No. 3. In No. 2, draw D K perpendicular to D B; and make D K equal to the height of eight steps; draw K S parallel and equal to D B; join B S; produce K S to T, and D B to V; make S T and B V each equal to the breadth of a step; draw T U and V W parallel to D K; make T U and V W equal to the height of a step; join W B, B S, S U; then W B S U is the line of nosings. The whole is completed as in No. 3, plate 10. Draw A X parallel to K D, cutting the upper side of the falling mould at X; draw X Z parallel to A D; produce K D to Z, and let K D cut the top of the rail at I; through C draw Y J, parallel to D K, cutting the top of the rail at J, and X Z at Y; then Y J and Z I, respectively, are the height of the resting points, whose seats are C and E, No. 3. In No. 2, draw J R parallel to B D, cutting D K at R. In No. 3, join the seats E and C, of the resting points, and produce E C to L. In J R, No. 2, find the point O, by making R O equal to E C, No. 3; join I O, and produce I O to meet X Z at Q. In No. 3, make E L equal to Z Q, No. 2., and join A L; through G draw H K, perpendicular to A L, and produce L A to H; through E

draw

draw E*i* parallel to L H, cutting H K at I; make I*i* equal to Z I, No. 2, and join H*i*, and produce H*i* to K. To find any point in the curve of the section, take any point M in the boundary of the plan, and draw M*p* parallel to E*i*, cutting H*i* at *p* and H I at P; draw *pm* at right angles to H*i*; and make *pm* equal to P M, and *m* is a point in the boundary of the rake. In like manner, let M P cut the concave side of the plan at N; in *pm* take *pn* equal to P N, and *n* is a point in the concave side. A sufficient number of points being thus found, draw a mixed line, *abcdefg*, through the whole, and *abcdefg* is the figure of the rake. For greater accuracy and dispatch, it will be necessary to find a point in the rake corresponding to the extremity of every straight line in the plan, as shewn by small letters of the same names as the capitals on the plan. The part A B F G being a parallelogram on the plan; the corresponding part *abfg*, on the section, is also a parallelogram; in this case it will be only necessary to find the points *a*, *g*, *f*. Join *ag* and *gf*; draw *ab* parallel to *gf*, and *fb* parallel to *ga*, and the point *b* gives the commencement of the convex curve *bcd*, and the point *f* that of the concave curve. It remains to be shewn that H L, No. 3, is the intersection of the plane on which the section of the prism is formed; for the point A is not only the seat of the lowest resting point, but the resting point itself. A is therefore the point in the intersection of the cutting plane. In No. 2, draw *o*Δ parallel to K Z, cutting B Z at Δ; conceive the triangle I Q Z to be removed to No. 3, so that the point Z may be upon E; and because R O Δ Z is a parallelogram, Δ Z is equal to R O, and R O is equal to E C by construction; therefore the point Δ will fall upon C; and,

and, by construction, the point Q will fall upon L. Conceive the triangle, with its base, thus coincident with LE, to be raised perpendicularly to the plan; I will be the resting point over E, and O the resting point over C; therefore the points I and E will be in the plane of section, and consequently be the straight line IOQ; but the point Q, now supposed to be coincident with L, is common to the plane of the base; and the plane of section, Q is therefore a point in the intersection of the cutting plane and the base. The point A has likewise been shewn to be a point in the intersection; therefore the straight line HL, passing through the points A and L, is the intersection of the cutting plane, with the plane of the base. The point L, No. 3, will be obtained also by a fourth proportional to IR, IZ, RO, or ZΔ, No. 1, setting it from E to L.

A mould being cut to the form of the section, as here obtained, is called by workmen, the *face mould*, which I shall suppose now to be made.

To find the Thickness of the Plank, out of which the Wreath is to be cut.

Let ZI, No. 2, cut the under edge of the falling mould, at ε, transfer ZE upon K *k*, No. 3, from K to *δ*; then the nearest distance between the point *δ* and the straight line H *k*, is the thickness of the stuff at the upper joint.

The wreath, when formed into two prismatic surfaces, and into two winding surfaces, is said to be squared. This formation is all that is required from geometrical principles.

principles. Then, supposing the wreath set in its proper position, every section made by a vertical plane, perpendicular to the convex side of the plan, will be a quadrilateral with its two vertical sides parallel, and at right angles to the upper side, and at oblique angles to the lower side. This arises from the top being so formed as to coincide in every part with the line perpendicular to the prismatic surface as defined, and the lower winding surface by gauging upon each cylindrical surface from the top.

To draw the Rake on the Sides of the Plank, in order to Plumb the two Sides of the Wreath.

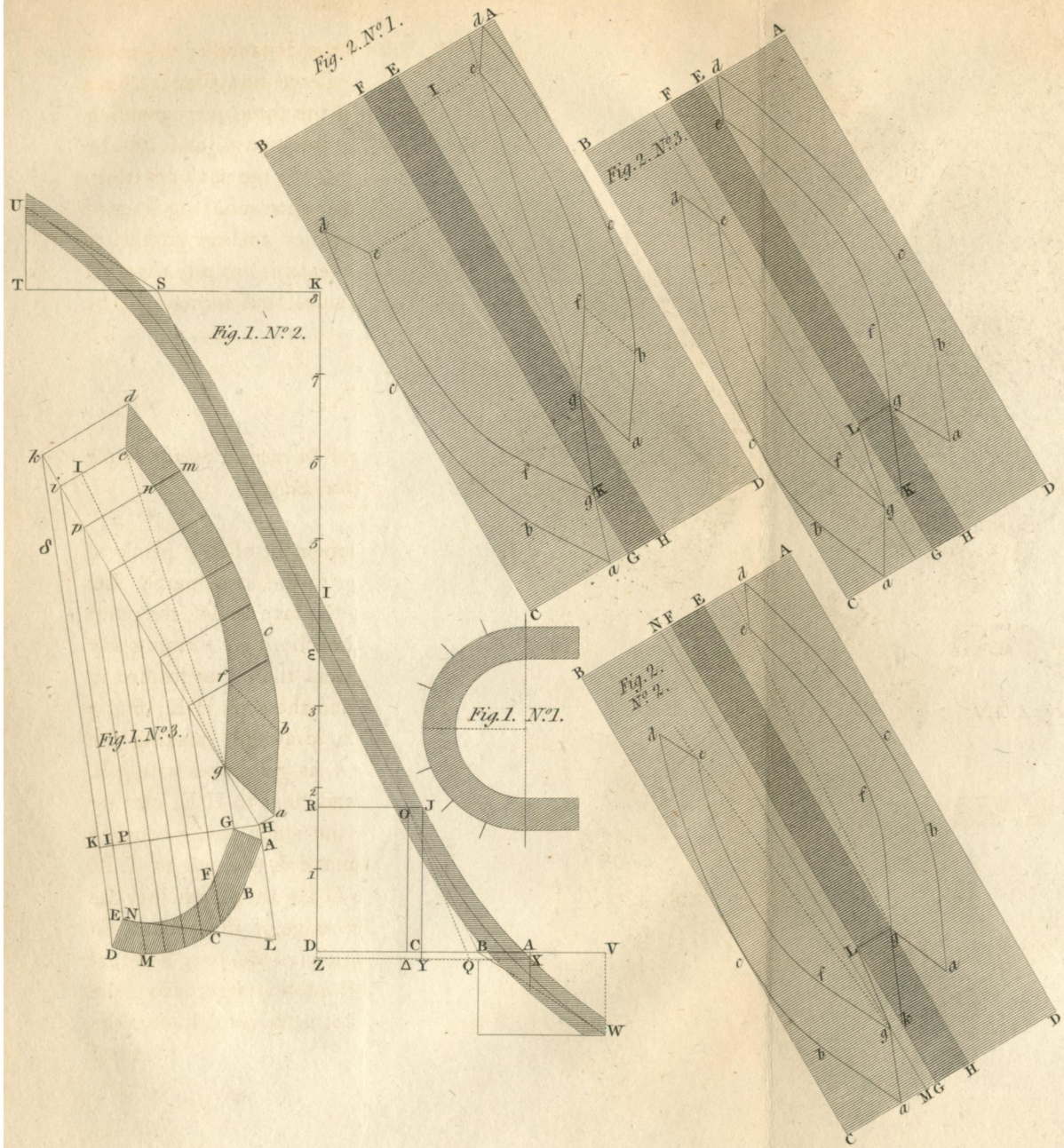
Let A B C D, fig. 2, No. 1, be a developement of three sides of plank; let A E, H D, be the top E F, G H, the edge in breadth equal to the thickness of the stuff obtained from No. 3, and F B, C G, the undersides; let the lines E H and F G, be parallel to *k* H, No. 3, in order to be more easily comprehended (as otherwise, it is not necessary), let *a b c d e f*, on the top of the plank, be the rake formed by the face-mould, the point *g* being in the line H E, and the line *g e*, making the same angle with *g* E as the line *g e*, fig. 1, No. 3, makes with *g k*, draw *g* K, making the angle H *g* K equal to the angle H *k* K, or H *i* I, or H *p* P, fig. 1, No. 3, cutting the arris, fig. 2, No. 1, G F, at K, then the same mould being drawn on the under side, with the point *g* at K, and the chord *e g* making the same angle with K F, that *e g*, on the upper side, makes with *g* E, or the distance of the point *e* from G F

G F, on the lower side, equal to the distance of the point *e* from H E, on the upper side. Let us now suppose lines drawn in the above manner upon the three corresponding surfaces of the plank to that of the figure, and let the plank be cut out with a bow saw. In the act of cutting, the kerf must be kept close to the corresponding lines of each rake, and the line of the teeth of the saw parallel to *g* K, and when the piece of the wreath is entirely divested of the superfluous wood, the sides thus formed will be plumbed.

To draw the Rake upon the Plank in every Position to the adjoining Arris of the Edge.

Let fig. 2, No. 2, be a developement of the plank as before, the same letters referring to the same parts. Let *a b c d e f g* be the rake drawn by the face mould, the point *g* being in the arris H E, and the chord *g e* forming any given angle with the arris H E, less than that formed in No. 1', fig. 2 by the chord *g e*, and the arris H E; find *g* as before from No. 3. In No. 3, draw *g* l, making the same angle with the pitch line *g k*, as *g e* makes with *g* E, in fig. 2, No. 2; draw *g* L perpendicular to H E, cutting the lower arris G F in L; make the angle K L *g* equal to the angle *e g* I, fig. 1, No. 3; make L *g* equal to L K, through *g* draw M N, parallel to G F; then, drawing the rake upon the lower side by the edge of the mould, so that the angle *e g* N, on the said lower side, may be equal to the corresponding angle *e g* E on the upper side; the two sides of the piece that is to form the wreath, may be plumbed

Mr. Peter Nicholson's Method of Squaring Hand Rails.



Drawn by M. A. Nicholson.

Engraved by J.B. Taylor.

plumbed as before, so as to correspond with the plan when set to its position.

If it is required to draw the rake with each extremity of the concave side of the mould in the arris of the plank as in fig. 2, No. 3, it is only making the angle K L *g* equal to the angle *e g k*, fig. 1, No. 3, the rest is drawn, and the plumb side is formed in the same manner as No. 1 and No. 2, fig. 2, which suppose to be done, bend the corresponding part of the falling mould, fig. 1, No. 2, round the convex side of the piece for the wreath; bring the points X and J to the plane at the top, and draw the line of support at the upper extremity upon the end of the wreath; now, bring the upper end of the falling mould close to the extremity of the line of support, and draw a line by the upper edge of the falling mould; cut away the superfluous wood in the manner before described, and this will form the back or top of the rail, then guage the two vertical surfaces to the same breadth, and cut the superfluous wood away from the under side; this portion of the rail will then be squared. The wreath for the other portion above, is identically of the same form, therefore, if two pieces are prepared by the same moulds and levels, then supposing one of these wreathed pieces to be set in its position for the lower part, and let the upper part be set in the same position, and then inverted, so that the top and bottom ends, and the upper and lower winding surfaces will have changed places, but each of the vertical surfaces kept still upon the same side; let the lower end of the higher piece be brought to contact with the higher end of the lower piece, that the two planes may coincide and form a joint; the helical solid for half a revolution will be formed out of a straight plank as required to be done.

The two wreathed portions of a hand-rail are not always alike, as in the preceding example, this may happen in different ways, as from one quarter of the semicircular part, being divided into winders, and the other undivided, or, from the rail being placed higher upon the winders, than over the flyers; but in whatever way the variation takes place, the application of the principle is the same, it only requires moulds to be constructed for every such variation, or separate part.

The intricacy of the diagrams constructed upon my former principles, prevented their being generally understood, and very few could practice with success. But the principles here laid down, are so invariable in their result, so simple and expeditious in their application, and so easily to be comprehended, even by a moderate capacity, that they cannot fail of being introduced into general use. They unite the requisite properties of saving labour and stuff, the workmen constructs his moulds with ease, and has less superfluous wood to remove. The edge of the plank is kept square, which entirely supersedes the bevelling, and is even in this point attended with a considerable saving of stuff and time, as it allows sufficient wood at the ends to make the heading joints, and as the piece which is cut out of the rail piece from the hollow side, may be turned into use; but if the edge of the plank were bevelled it would require to be much longer, in order to form the heading joints, and the piece cut out would be too trifling to be employed to any purpose.

In addition to the advantages already enumerated, the workmen will be encouraged by the clearness of the different steps of the process, which cannot fail of fully satisfying his mind as to the final result.

It

It is likewise a great accommodation, that any rail whatever may be cut out of the same thickness of plank, and that the mould may be applied in any direction which the workman pleases to the surface, in order to save wood or match the fibres at the joint.

The art of forming hand-rails round circular or elliptic well-holes without the use of a cylinder, is entirely new.

PRICE, the author of the "*British Carpenter*," is the first person who seems to have had any idea of this art; the subsequent writers following his schemes, which were very uncertain in their application, have added nothing to the subject, but have even thrown it into greater obscurity.

The first successful method of squaring the wreath or twist, was invented and published by me, in the "*Carpenter's Guide*," in 1792; and certainly was the first wherein the process was subjected to any thing like geometrical principles, from which the result was attended with success. In the "*Carpenter's Guide*," (generally called simply "*The Guide*,") the formation of the face mould was regulated by the falling mould or the developement of the rail, not by the rise and tread of the steps, as shewn by Price and his followers. When the back or upper surface of the rail had a considerable concavity, as in the case of the junction of flyers and winders, the consequence of this regulation in many cases in the formation of the rail was the saving of seven or eight inches in the thickness of stuff; and thus while the method laid down by Price required a plank from six to nine or ten inches in thickness, according to the degree of concavity; that in the Guide seldom required a plank more than three inches thick, excepting in small well-holes of three or four inches diameter.

From the great thickness of stuff to cut through, and

the quantity to be taken away, the time required to form the piece of wood into a wreath by Price's method, must have been at least double to mine in "*the Guide*" and proportionally more so, as the thickness of the plank required by Price, was greater than that in *the Guide*.

But though considerable advantages were thus obtained in the saving of stuff and labour, it must be observed that an elevation of the supposed vertical ends of the twisted piece at each joint, and a vertical section of the said piece were employed to obtain the inclination of the plane of the face of the mould, or that of the faces of the plank; this inclination was only correct when the planes of the faces of the plank were at right angles with the chord plane, or that passing through the chord of the plan of the wreath; but when inclined to the chord plane, required thicker stuff, in proportion to the degree of obliquity, whether more acute or more obtuse.

The method shown in "*The Guide,*" was also the first attempt to spring the plank, that is, to make its plane rest upon three parts of the rail; and though the utmost degree of perfection was not attained, it has been of great use to workmen, as all the hand-rails of stairs in and about London, and in most parts of England, have been executed upon its principles for upwards of twenty years.

In order to obtain still greater correctness, I tried another method, by setting up three heights, supposed to be on the surface of a curved prism, in the middle of the rail; but this, though still nearer than that published in "*The Guide,*" did not give me entire satisfaction; for the resting points being in the middle of the rail, the plane of section which formed the face mould did not clear all

the

the three sections without cutting into the solid of the wreath.

In the pursuit of truth, I was led to consider what would be the real resting points. It readily appeared, that a level line drawn towards the axis of the well-hole, might be made to coincide in every part with the top of the rail; that if the plane of the top of the plank be supposed to be placed on three vertical sections of the supposed rail in contact with a point in each, or coincident with the whole line of support of one of the sections, and with a point in each of the other two; and the surface of the plank thus inclined be supposed to be prolonged, to intersect the horizontal plane of the base, the intersection would always point out the resting points, and shew their true seats upon the plan. From this consideration, it was evident that the resting point of each section, and consequently each seat, was that extremity of each section next to the intersecting line of the plane of the plank and that of the plan.

This theory being applied to practice, has given the utmost satisfaction, both in the saving of stuff and time; the diagram for the face mould is completely divested of all cross and oblique lines, and is, perhaps, in the most simple form to which it can possibly be reduced; the plane of section comes in contact with the tops of three vertical sections of the rail in every case whatever, and thus every desideratum is obtained by the most simple means.

Therefore, in practice, if we suppose the section of the rail to be two and a quarter inches horizontally in breadth, and two inches in thickness (as is generally the case), a

plank of two and a half inches thick will be sufficient for a rail, with any degree of concavity or convexity on the back.

SIR,

I have herewith sent you the drawing and description of the additional plate for my article upon hand-railing; the plate, I trust, will give just representations of the solids themselves, which, with the explanation, will be satisfactory in forming a perfect idea of the execution of the work.

I am, Sir,
Your most obedient servant,

PETER NICHOLSON.

Oxford-street, June 1st, 1815.

To C. TAYLOR, M.D.
Secretary to the Society of Arts, &c.

Reference to Plate 12.

Fig. 1, is a plan of the cylinder, with the elevation of the helical line, which is found by dividing the height into equal parts, and the circumference of the base into equal parts also, then drawing the lines through the points of division, as in the figure.

Fig. 2, a representation of the solid helix twisting round the cylinder, making a continued rail upon a circular plan; the curvature of the solid helix is, therefore, every where the same. The rail is exhibited as squared; and

Mr. P. Nicholson's Method of Squaring Hand Rails.

Fig. 1.

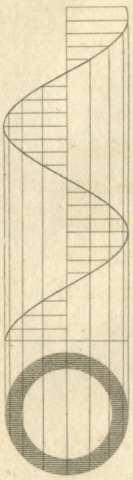


Fig. 2.

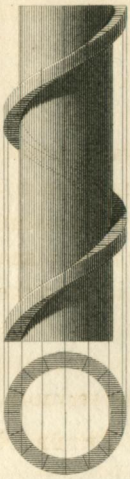


Fig. 3.

No. 3. No. 2. No. 1.

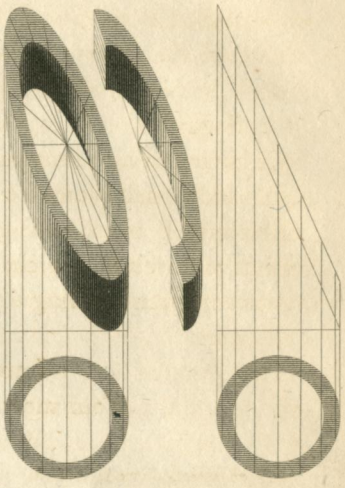


Fig. 4.

No. 1. No. 2.

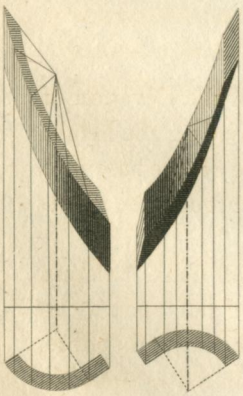
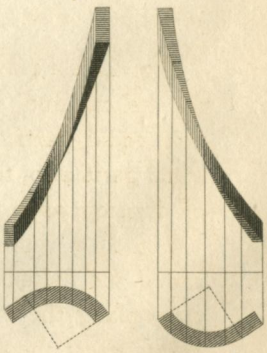


Fig. 5.

No. 1. No. 2.



Drawn by M.A. Nicholson.

Engraved by J.B. Taylor.

and though it appears as one piece, it must be understood to consist of several wreaths, or lengths, screwed together, each length answering to a quadrantal part of the plan.

Fig. 3, shows the different sections of a hollow cylinder, cut entirely through the curved surface, the solids exhibit a portion of the said cylinder contained between two parallel planes: No. 1. shows the thickness of the section according to the inclination of the cutting plane; No. 2, shows the section of a semicylinder, and No. 3, that of an entire cylinder, cut according to the position of No. 1.; the sections, No. 2. and 3., being turned round, so that the plane of section may be brought into view, in order to make the solid appear.

Figure 4, exhibits a solid section of a hollow cylinder, upon a quadrantal plan, with a small part straight; No. 1. exhibits the convex side, No. 2. the concave side. This figure shows the state of the rail-piece as prepared by the face-mould, and is therefore bounded by two concentric cylindrical surfaces, and two parallel planes. The falling mould being applied upon the convex side, the superfluous wood is cut away according to a line drawn by the upper edge of the falling mould, in such a manner that the stock of the square, being applied upon the convex side, parallel to the axis, the under edge of the blade may coincide with the top or winding surface of the rail-piece. The thickness of the rail is regulated by running the stem of a guage first upon the convex side, with the head upon the top or winding surface, and then the stem upon the concave side in the same manner, and cutting away the superfluous stuff between the two gauge lines.

Fig. 5, exhibits the wreath, or rail-piece, as completely

squared: No. 1. shows the concave side, with the lower end of the back, or upper surface, and the higher end of the lower surface; and No. 2. the convex side of the cylindric surface, with the upper part of the back, and the lower part of the under side.

The rail exhibited in figure 2, is only a succession of wreaths, as in figure 5.

From what has been shown, it will be easy to conceive how a rail may be executed to any given plan, and to any developement of the steps according to that plan.

Though it may be possible to make a rail in one piece, as in figure 3, No. 3, such a rail will hardly ever come into practice; the representations of the solid sections, in Nos. 2 and 3, are therefore not shown with a view of being prepared for a rail, but to give a clear view of the different parts of the solid sections of a hollow cylinder.

PETER NICHOLSON.

The SILVER MEDAL *and* FIVE GUINEAS, *were this Session voted to Mr.* HENRY WARD, *of Blandford, for an Equation Work for a Clock. The following Communication was received from him. An Explanatory Engraving is annexed, and a Model of the Apparatus is preserved in the Society's Repository.*

SIR,

I HAVE often thought that, if some cheap and simple mode of shewing the sun's apparent duirnal motion by a clock

clock could be contrived, it would not be the least useful and convenient improvement in the artificial measure of time. For as the sun's apparent motion is constantly varying from his mean motion, and the difference arising from this variation sometimes amounts to more than a quarter of an hour; and further, if the great perfection to which pendulum clocks are arrived at in the present day, and the extreme accuracy with which they are capable of representing mean solar and sidereal motions, are considered, there seems no sufficient reason why an error of such magnitude should be entirely neglected. Agreeably to this idea, I send, for the inspection of the Society for the Encouragement of Arts, Manufactures, and Commerce, a model of an equation apparatus, which I invented and applied to a regulator that I made about six years ago, and which is found to perform extremely well.

The application of the equation of time, or rather, the sun's apparent diurnal motion to a clock, is by no means a recent discovery. Several clocks of this kind were made nearly a century ago, both in England and in France; but the complexity of their construction, the extreme difficulty of execution, the incapacity of the greater number of workmen, to which may be added the expence, have operated as insurmountable obstacles to the introducing them into general use: so that, for many years past, clocks of this description have been but little in request, and the making of them laid aside, and almost forgotten.

The first clock of this kind that we have any acconut of, was found in the cabinet of Charles the Second, King of Spain, about the year 1700, as may be seen in Sully's *Regle Artificielle du Temps*, edit. 1717. But the author of this curious invention did not then appear to be known.

Mr.

Mr. Williamson, an English artist, however, in the Philosophical Transactions, No. 363, asserts his right to it, and says he is well satisfied that this clock is one which he made for Mr. Quare, who sold it soon after, to go to the said Charles the Second, King of Spain. Mr. Williamson has not given us a description of the mechanism, but merely states that there were two fixed and two moveable circles; the former shewing the hour and minute of mean time, the latter, which were concentric to the former, that of apparent time. In the same paper he also tells us, that shortly afterwards he made other clocks for shewing apparent time, by raising and depressing the pendulum through a slit in a piece of brass, so that its vibrations would agree with the sun's apparent motion throughout the year.

Equation clocks were first made in France, about the year 1717, by M. le Bon and M. le Roy; though a project of this kind, by the Reverend Father Alexandre, was laid before the Academy of Sciences, as early as 1698. The clocks constructed by M. le Bon, scarcely differ from that in the King of Spain's cabinet; they had two concentric circles, one of which was moveable, and its motion was regulated by an equation plate, that performed a revolution in a year. Clocks, and watches too, with moveable circles, have since been made with some improvements, by several French artists; and, as far as simplicity is concerned, are perhaps the best of any that have hitherto been constructed.

A much more elegant mode of shewing mean and apparent time, is by two minute hands; one of which moves concentrically to the other, and has a piece of brass attached to it representing the sun, to distinguish it from that which points out mean time. Some excellent clocks

of

of this sort have been made by GRAHAM; they have likewise been made in France, by LE PAUTE, PASSEMENT, BERTHOUD, &c.; but all of them are so extremely complex, that it is no wonder they have not been more generally in use. These clocks require not only an annual motion, in common with all others of the kind, but there is an addition of several wheels to the minute work, that renders them extremely difficult of execution, and, without great care, liable to considerable sources of error.

The model herewith sent has two minute hands; it has no real annual movement, but only a relative one. By these means, the construction is rendered simple, and the execution easy. It may be made in less than a week by any ordinary workman who comprehends the use of its parts.

I cannot conclude this letter without expressing my regret that we have no complete Treatise on Clock and Watch Work in the English language. It is more to be lamented, because this country stands pre-eminent in the mechanical arts; and the greater number of useful inventions and improvements have been made by English artists. Some excellent works on the subject have been published in France, Germany, and even in Spain. For the honour of our country, as well as for the benefit of the public, let us hope that some geometrician and mechanist will one day favour us with a work on a subject of so much importance—a work certainly much wanted at the present time.

I am, Sir,

Your most obedient servant,

HENRY WARD.

Blandford, March 21, 1814.

To C. TAYLOR, M.D. SEC.

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Description of Mr. HENRY WARD'S *Equation Work for a Clock.*

It will be proper first to explain the principle upon which the annual motion is founded; when that is done the rest will be easily understood. It consists of the difference of velocities of two wheels, that turn concentrically to each other; to effect which the following numbers are employed:

111. 79.
137. 64.

If 111 be multiplied by 79 the product will be 8769; and 137 multiplied by 64 gives 8768 the difference being unity. Now if the wheel of 111 teeth be made to revolve in an hour, the end is obtained; for it makes one revolution less in a year than the wheel of 137 teeth. It may be observed, however, that 8768 hours exceed a tropical year by a little more than two hours; but this difference is so extremely small, that in practice it may be altogether neglected, for the error will not become sensible till after several years.

Reference to the Engraving of Mr. H. WARD'S *Equation Work for a Clock.* Plate 13. Fig. 1, 2, and 3.

The mechanism will be best explained by a profile. A, A. Fig. 1 represent a steel arbor, to which is fixed a nut B of 24 teeth; this arbor also carries the apparent time hand 1. C is the minute wheel of 111 teeth, screwed to a brass socket *b*, *c*, which turns on the arbor A A; the end of this socket is the fore pivot to the arbor, is armed with steel,

Mr. H. Ward's Equation Work for a Clock.

Fig. 3.

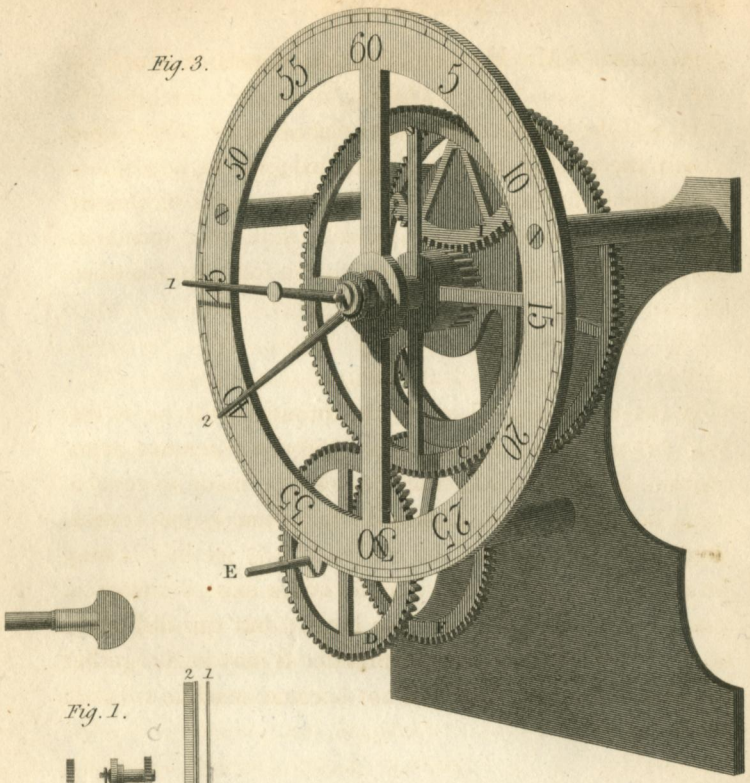


Fig. 1.

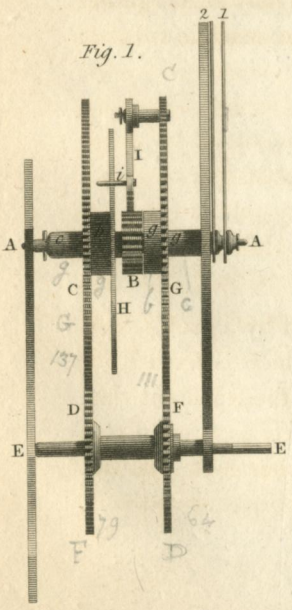
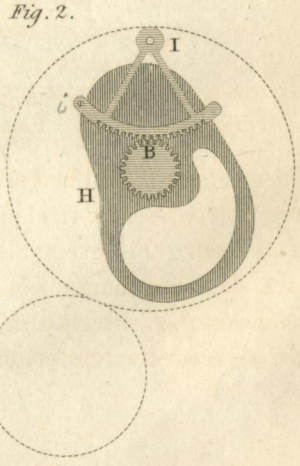


Fig. 2.



Drawn by M. A. Nicholson.

Engraved by J. B. Taylor.

steel, on the extremity of which is the mean time hand 2. The minute wheel drives a wheel D of 64 teeth, keyed on the arbor E E; the fore pivot of this arbor is squared, by which it may be turned at pleasure, so that the equation may be set right, by means of a table, if at any time the clock should have stopped. On the same arbor is fixed another wheel F, of the same diameter, containing 79 teeth, that drives a wheel G of 137 teeth screwed to the socket *g*, *g*; this socket turns freely on the arbor A A, and to it is also screwed the equation plate H. In the periphery of the wheel C there is a stud carrying a toothed quadrant II, which works in the nut B; a pin *i* is fastened in one extremity of the quadrant, which, by the revolving of the equation plate, is moved backwards and forwards; but in order to keep the pin in contact with the plate, a piece of very narrow watch spring is inserted in the boss of the minute wheel, hollowed out for that purpose; this spring, which ought to be weak, is hooked to the arbor of the nut B.—*Fig.* 2 represents a front view of the quadrant, nut, and equation plate 2, by which the operation may be readily understood.

This apparatus cannot conveniently be placed on the centre pinion so as to derive its motion from it, but motion may be communicated from the movement to the minute wheel in any way the ingenious artist may judge best calculated to suit the particular construction of his clock.

Of dividing the Equation Plate.

As the dividing the equation plate may appear difficult to many, I have judged it necessary to offer some directions

tions to facilitate the business. For this purpose, I have constructed an Equation Table for a year, divided into 137 parts, each part consisting of an interval of 64 hours, and consequently corresponding to one tooth of the wheel, which carries the equation plate. By this means the operation of dividing the plate is rendered as easy as that of a common snail. The method is as follows:—Having fixed in the extremity of the quadrant a temporary screw with a sharp point, I put the minute wheel with the quadrant, and the wheel of 137 teeth with the equation plate upon the arbor A A, and placed them in the frame. A piece of iron wire flattened, with one end bent to a right angle, was held fast to the frame by a hand-vice, with the bent end resting in the teeth of the wheel, so as to retain it in any position. The minute wheel was made fast to the frame by a clamp, the mean time hand pointing exactly to 60 on the minute circle; the apparent time hand was then brought to 60 also, and the screw in the quadrant, whose point was nearly in contact with the plate, was gently struck with a hammer, so as to make a small impression; I then shifted the plate forwards by one tooth of the wheel, and moved the apparent time hand forwards, as near as the eye could judge, 39 seconds, *(see the annexed table)* and made a second impression; then moved the wheel another tooth, and set the hand to 1 minute 14 seconds; and thus I proceeded until I had got a series of dots all round the plate, to which it was afterwards filed away.

A Table

A Table useful in dividing the Equation Plate.

M S	M S	M S	M S	M S	M S
0.. 0	0..37	2..51	15..40	1..29	12..41
+ 0..39	1..11	2..12	15..57	2..47	12.. 7
1..14	1..46	1..29	16.. 8	4.. 9	11..30
1..46	2..20	− 0..42	16..15	5..18	10..50
2..16	2..54	+ 0.. 6	16..16	6..28	10.. 7
2..41	3..25	0..56	16..10	7..36	9..23
3.. 4	3..55	1..49	15..58	8..40	8..37
3..22	4..22	2..43	15..41	9..40	7..49
3..37	4..47	3..38	15..17	10..35	7.. 1
3..48	5.. 8	4..33	14..47	11..25	6..11
3..55	5..27	5..29	14..12	12.. 9	5..22
3..58	5..42	6..25	13..29	12..47	4..32
3..56	5..54	7..21	12..43	13..20	3..48
3..50	6.. 2	8..16	11..50	13..47	2..55
3..41	6.. 6	9..10	10..54	14.. 7	2.. 8
3..27	6 . 5	10 . 1	9..52	14..23	1..23
3..10	6.. 0	10..52	8..42	14..32	0..40
2..49	5..31	11..40	7..36	14..36	0.. 0
2..26	5..37	12..26	6..24	14..35	
2.. 0	5..19	13.. 8	5.. 8	14..28	
1..32	4..57	13..47	3..50	14..16	
1.. 2	4..31	14..22	2..30	13..59	
+ 0..30	4.. 1	14..52	+ 1..10	13..37	
− 0.. 4	3..28	15..19	− 0..10	13..10	

The

The SILVER MEDAL *was this Session voted to Mr.* WILLIAM HORN, *of Chatham, for a Machine for cutting Canvas for Shipping. The following Communication was received from him, an Explanatory Engraving is annexed, and a Model of the Machine is preserved in the Society's Repository.*

SIR,

A FRIEND of mine, who resides in the country, has invented a machine to cut canvas, for the use of riggers in His Majesty's Dock Yards, which has been much approved of by the several Commissioners at Chatham, Plymouth, &c., and is in constant use at those places. The saving to Government both in labor and canvas, is undoubtedly very considerable. He is desirous of submitting a model of the machine to the Society for the Encouragement of Arts.

The inventor can procure Certificates from Sir Robert Barlow, the Commissioner at Chatham, and the other distinguished Officers of the Dock Yards, on the usefulness of the machine. No patent has been applied for for it.

I have the honour to be,

Sir,

Your most obedient Servant,

J. BROTHERS.

No. 9, New Broad Street,
October 23d, 1812.

To C. TAYLOR, M.D. SEC.

CERTIFICATES.

A Copy by G. DAVIS, by Order of SIR ROBERT BARLOW, Commissioner of Chatham Yard.

Chatham Yard, August 18th, 1807.

SIR,

IN return to your minute of 15th instant, to report on the machine (invented by Mr. WILLIAM HORN,) for cutting out reef, middle, and foot bands, also parcelling for the riggers; we beg leave to inform you, that since the date of your minute in May, 1806, the said machine has invariably cut out all the new and old canvas that has been appropriated to the above purposes, and that we find it in every respect to answer extremely well: moreover, much time and expense is saved in the rigging house by its adoption; and as old canvas, previous to the said date, was issued in large quantity to the rigging house, it gave an opening to embezzlement, whereas the mode of cutting it in slips by the machine, will, in a great degree, prevent it.

We are, Sir,

Your obedient humble Servant,

SAMUEL HEMMANS, Master Attendant.

WM. BEARE, Master Sail-maker.

To CHARLES HOPE, Esq.
Commissioner, Chatham Yard.

THIS is to certify, that the machine for cutting of canvas, invented by Mr. WM. HORN, has been, and now is constantly in use from the period of its adoption for ge-

neral use by the Hon. Navy Board, in 1807. And the said machine is still found for its utility highly beneficial to the Service. I conceive the advantage arising from it to be very considerable. I further add, that the said WM. HORN is the sole inventor, as to my knowledge nothing of the kind was mechanically in use, or under the idea of any person, until Mr. HORN presented the said machine for the naval service.

M. BEARE, Master Sail-maker.

Chatham Yard, Nov. 24th, 1812.

FURTHER Certificates from Mr. URIAH ALLCHIN of Chatham, Turner, Mr. JOHN COCKUP of Chatham, Carpenter, Mr. THOS. FREELAND, Mr. ROBERT SEPPINGS, H. M. Dock Yard, and T. HULKES, Esq. of Rochester, one of His Majesty's Justices of Peace, were received in confirmation of Mr. WM. HORN being the inventor of the said machine.

Directions for using the Machine.

First, fix the knives in the knife bar according to the width that may be wanted.

When thus fitted, raise them in a perpendicular direction, then convey the canvas between the two lower rollers, passing it between the two upper ones under the knife bar on to the receiving bar, when fastened, tighten the canvas in the machine, and put on the weights, turn the knives down on the canvas and cut it through; fix the knife bar firmly by the screw on the side. Observe, that as the canvas increases on the receiving bar, so it passes down the

the edges of the knives to the points, and should, when a bolt of canvas is finished cutting, be one inch of the edges to spare. The distance of the knives from each other are calculated for two feet canvas, (the standard width in England,) allowing in the third and fourth cut bands the middle pieces to be wider than the outside ones, in consequence of the salvage, which does not want turning in as the middle pieces do; there is allowed one inch on the width of the rollers, lest the canvas exceed in any shape, as it is in practice found to vary in its widths.

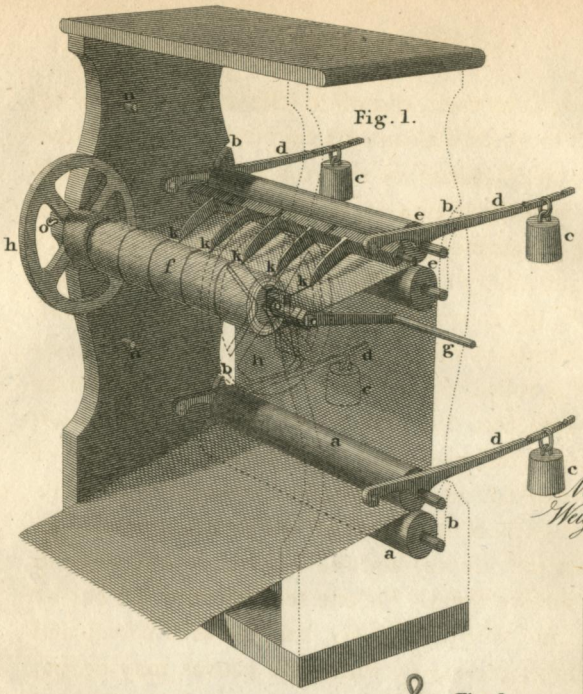
WILLIAM HORN, Inventor, Chatham.

Reference to the Engraving of Mr. HORN'S *Machine for cutting Canvas. Plate* 14, *fig.* 1, 2.

The canvas is first passed through the two bottom rollers *a a*, (these rollers fall easily into their places in the frame of the machine, by their pivots going into groves *b, b,*) then through the two upper rollers *e, e,* (these also fall into their places in the same manner as the two others) and the upper roller of each pair is pressed down on the canvas by weights *c, c, c, c,* hung on the levers *d, d, d, d,* each under roller is as long as the width of the frame, but the upper ones are made a little shorter that the levers *d, d, d, d,* may fall on the pivots, between their ends and the frame; there are notches on the longer ends of the levers to adjust the weights, by bringing them nearer to, or farther from the rollers. One end of the canvas is then fastened to the roller *f*, which has a winch *g*, to turn it round by, (the near side of the frame is shewn in dotted lines in order the better to see the work within,) this roller

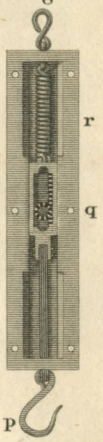
has wheels *h*, *h*, at each end of it (the nearest shewn by dotted lines to guide the canvas straight on the roller; the knives *k*, *k*, *k*, *k*, *k*, are screwed into a bar of iron *i*, which is so fixed into the frame as to keep the knife points a little below the surface of the canvas, when drawn tight; the knives are sharp from the point to the bar, and almost laid on the canvas, so that the cut is begun before the canvas comes to the point, then by turning the winch the canvas is rolled tight round the roller *f*, and cut as fast as it goes into the number of slips the knives are placed for; the tightness, and consequently the cutting of the canvas depends on the resistance given by the weights *c*, *c*, *c*, *c*, pressing on the pivots of the rollers *e*, *e* and *a*, *a*. Fig. 2 shews the knives, and the holes and the groves in the bar to receive them; *l* is one screwed into the bar by its nut *m*; one side of the bar has groves for five, and the other three knives, by which the canvas may be cut into 2, 3, 4, or 6 equal slips, according to the number of knives employed; *n n* are pins to throw the lever's back against, while putting in or taking out the rollers; *o o* two pins, which keep the great roller *f*, in its place.

Mr. W.m Horn's Machine for Cutting Canvas.



Mr. W.m Martin's Weighing Machine.

Fig. 4.



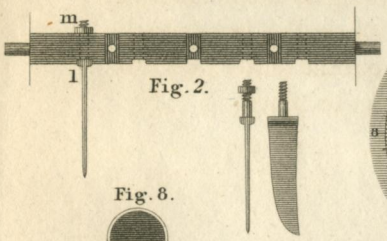


Fig. 8.

Fig. 3.

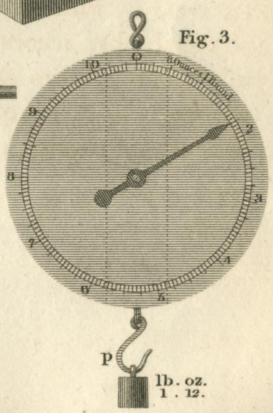


Fig. 7.

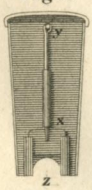
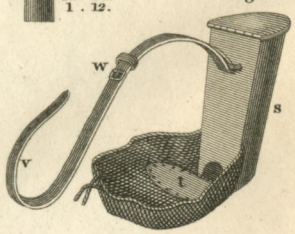


Fig. 5.

Fig. 6.



Mr. Co. Drury's Horse Feeder when Travelling.

C. Varley del. G. Gladwin sc.

The SILVER ISIS MEDAL *and* TEN GUINEAS *were this Session voted to Mr.* W. MARTIN *of High-st. Mary-le-bone, for an Index Weighing Machine. The following Communication was received from him, an explanatory Engraving is annexed, and one of the Machines is preserved in the Society's Repository.*

SIR,

I HAVE invented an improved method of weighing things of any nature, by a machine, which is very portable. The effect is produced by means of a helical spring acting within a tube or case, which spring contracts or lengthens according to the weights of the different bodies suspended from it. The weight is shewn on a graduated circle, to which an index points. I beg leave to submit it to the Society for their approbation,

I am, Sir,
Your humble and obedient Servant,
WILLIAM MARTIN.

No. 75, *High Street, Mary-le-bone,*
Dec. 6*th*, 1813.

Reference to the Engraving of Mr. MARTIN'S *Weighing Machine, shewing the Weight of any thing by an Index on a Dial Plate.* Pl. 14, fig. 3, 4.

The articles to be weighed are hung on the hook *p*, and the weight, viz. 1*lb*. 12*oz*. is pointed out by the index on the dial plate fig. 3; fig. 4 is a pinion under the dial plate on

the inside of which the index is fastened; this is enclosed in a brass frame, with a rack on one side of it, to move the pinion. The helical spring *r* keeps this rack held up. The articles to be weighed being put on the hook *p* attached to the rack, pulls down the rack *q*, and consequently turns the index; and the place on the dial-plate, where one pound pulls the index to, must be marked as one pound; where two pounds turn it to, marked as two pounds, and so on, till the whole circle is marked, and then these pounds must be also divided into ounces, which fits the instrument for use. Fig. 4 shows the rack-spring and pinion enclosed in a case screwed to the back of the dial-plate, and to the upper part of which the spring is fixed, its lower part being connected with the frame of the rack; and the instrument is held or suspended by a hook at its top.

The Silver Isis Medal was this Session voted to Mr. CHARLES DRURY, *of Mansfield, for a Method of feeding Horses, when travelling or standing in the Street. The following Communications were received from him. An explanatory Engraving is annexed, and the Apparatus preserved in the Society's Repository.*

SIR,

I BEG leave to submit to the inspection of the Society of Arts, &c. an improved apparatus for feeding horses, which can be used where the common nose-bags cannot. Considerable quantities of corn have been lost by

by horses refusing to eat their corn when blown upon in the nose-bags, or by throwing out the corn during the time of feeding. Both these inconveniences are obviated by the present plan, as the quantity of corn permitted to descend into the feeder can be regulated at pleasure, by a slide within the case, and the horses are not impeded in their breathing whilst using this machine, but may even be fed by this means whilst travelling at a moderate pace.

I remain, Sir,

Your humble servant,

CHARLES DRURY.

December 22, 1813.

To C. TAYLOR, M.D. SEC.

CERTIFICATES.

This is to certify, that I have fixed Mr. Charles Drury's travelling feeder upon several of our horses, in the presence of Captain Kynon. They take to it wonderfully, though they never had one on before; and by feeding them gradually, it will answer exceeding well in every respect, and is far before the present nose-bags for feeding his Majesty's Cavalry and other horses, when upon their march, or on the road, without loss of time. It is so constructed, that horses can take their feed without throwing their heads up, or putting the feeder to the ground.

It will not prevent horses from breathing whilst drawing in a cart. They cannot blow upon their food; and army horses will be able to take their feed whilst travelling at nearly the rate of four miles an hour, with the same

ease as if standing in the stable, and the apparatus can be taken off or fixed on in a minute's time.

ROBERT HEWITT,
Quarter-Master of 2d Life Guards.

December 18, 1813.

SIR,

I HAVE the pleasure to acquaint you that, agreeably to the request of the Society's Committee of Mechanics, I have again fixed Mr. Drury's travelling feeder upon several of his Majesty's Cavalry horses, and find that it answers exceeding well. Any horse, though he has never tried one before, will take to it immediately, and feed in the same manner as if standing in the stable, whilst travelling at the rate of three or four miles an hour; and a horse in military service is frequently very valuable.

It will prove of great national good for the feeding of all other horses when drawing carriages, or waggons, or in ploughing, &c. It will prevent loss of time, and be the means of saving the lives of many horses; it will save a great quantity of corn usually wasted in feeding them with the common nose-bag, as, when they have blown upon it, they will not eat it up clean. It can be carried upon military horses on their march with great ease.

I am, Sir,
Your obedient servant,

ROBERT HEWETT,
Quarter-Master, 2nd Life Guards.

Horse Guards,
December 25, 1813.

To C. TAYLOR, M.D. SEC.

THIS

THIS is to certify that Mr. Drury's travelling horse feeder, will prove of very great advantage, as there is no doubt that horses in the army, and all other horses, when drawing of carriages, waggons, ploughs, &c. will be able to take their food when upon the road, as sweet and clean as in the stable, without loss of time, which has been proved with his Majesty's cavalry horses at the Horse Guards, when going at the rate of two to four miles in the hour. It prevents any waste of corn, and likewise keeps the horse from blowing upon it; and the apparatus is so constructed as not to prevent him in the least from breathing.

H. LATHAM,
Quarter-Master, 2nd Life Guards.

Horse Guards,
January 3, 1814.

To C. TAYLOR, M.D. SEC.

Reference to the Engravings of Mr. DRURY'S *Traveller's Horse Feeder.* Pl. 14.—Fig. 5, 6, 7, 8.

PLATE 14, fig. 5, shews the horse-feeder in use, strapped on a horse's head.

Fig. 6, the same off the horse. The tin vessel, or case, *s*, with a moveable lid, which contains the corn; *t*, the tin plate off which the horse feeds, surrounded by canvas, which is sown to the tin plate, and also to the sides of the tin case; this draws up like a purse, or bag, by a string run in the edge of it, which is tied round the muzzle of the horse. The strap *v* goes over the horse's head, through a ring under the plate *t*, and turns up again into the buckle *w*, where it is made fast.

Fig.

Fig. 7, the inside of the tin case, with a tin plate, *x*, sliding between two pieces of tin, as guides, and can be moved by the wire *y*, so as to shut or open more or less the hole *z*, through which the corn falls on the feeding-plate; this wire has a loop at its end, to hook on a pin at the top of the case, and prevent its slipping down; by this register, the horse may be fed quick or slow, and may even feed whilst travelling, as well as when standing still.

Fig. 8, the bottom of the tin vessel, and feeding-plate hinged to it, with the holes round it to which the bag is sewed; the bottom of the vessel slopes towards the hole, so that all the corn may come out of it, which it will do by the shaking of the horse's head, but cannot be lost, owing to the canvas so closely surrounding the horse's muzzle.

The Gold Isis Medal was this Session voted to Mr. F. FOLSCH, *of Oxford Street, for his Method of teaching young Persons to read and write. The following Communication was received from him. An explanatory Engraving is annexed, and Specimens of the Apparatus are preserved in the Society's Repository.*

SIR,

OF late years, peculiar attention has been paid to devise and mature plans which appear calculated to dispel the clouds of ignorance, and gratitude will induce succeeding generations to revere the memory of two illustrious characters, whose discoveries in promoting the education of children,

children, evidently tend to better the condition of the poor, to promote the good order of society, and to exalt the national character. In hopes that I may be permitted to contribute my endeavours, I beg leave to lay before the society a plan which I conceive will promote, in no inconsiderable degree, the education of the rising generation. The high opinion I entertain of the members composing the Society of Arts, &c. makes me anxious to have the honour of submitting my invention for facilitating the attainment of the elements of reading, writing, arithmetic, and drawing. The liberality of their sentiments induces me to hope that I shall meet with the same indulgent candour as those who are natives of the favoured shores of Albion*, having contracted, from a long residence in this happy country, a similarity of interests, sentiments, and feelings, with them.

The apparatus has obtained the approbation of numerous literary characters. It has lately been examined by a nobleman of great scientific attainment, and he has been pleased to bestow an encomium on it.

I shall be ready at any time to attend to explain its utility. I am, with the greatest respect,

Sir,

Your most obedient humble servant,

F. FOLSCH.

No. 237, *Oxford Street, Jan.* 26*th*, 1814.

To CHARLES TAYLOR, M.D. SEC.

CERTIFICATES.

SIR,

I HAVE carefully examined your invention for the in-

* Mr. Folsch is a native of the Dutchy of Courland.

struction

struction of youth in the art of writing, which you call *The Juvenile Instructor*, and I have no scruple of giving my opinion that it is admirably adapted for that purpose.

STANHOPE.

Berner's Street, Jan. 8, 1814.

To Mr. F. FOLSCH, Oxford Street.

WE, whose names are hereunto subscribed, having seen and minutely examined the recent invention of Mr. F. Folsch, of Oxford-street, denominated by him *The Juvenile Instructor*, beg leave to express our entire approbation of his discovery, for the prospect it presents of becoming a great advantage to the public, while we perfectly agree in the originality of the invention, as far as its application is concerned in promoting the education of the rising generation.

SAMUEL HACKETT, Chapel Court, South Audley-street.
E. A. DUNN, Stafford Row, Pimlico.
HUGH DAVIES, Piccadilly.
THOMAS WILSON, Tyndale Place, Islington.
W. F. LLOYD, Mason's Hall, Basinghall-street.
ALEXANDER FLETCHER, Minister Scots Church, Miles's Lane.
THOMAS COMYN, late Minister of Kennington Chapel.
JOHN DAVIES, Surgeon, 227, Piccadilly.
Dr. ESSEX, Turnham Green.
E. TURNER, Academy, 33, Hart-street, Covent Garden.
WILLIAM DOBSON, 166, Strand.
ROBERT I. THORNTON, Member of the Royal College of Physicians.

WILLIAM

Mr. F. Folsch's Substitute for a Slate.

Fig. 1.

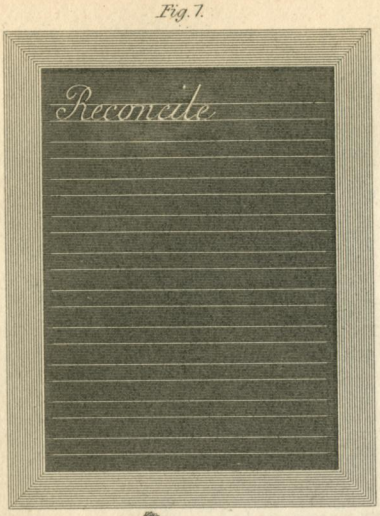


Fig. 2.

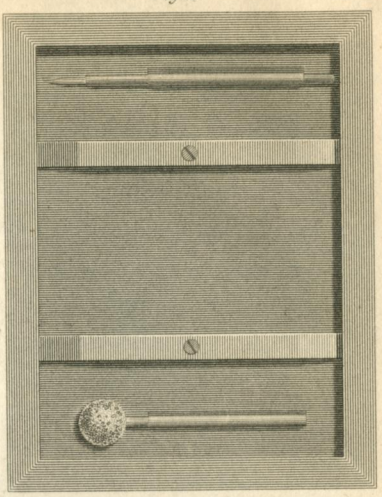


Fig. 3

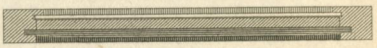


Fig. 4.

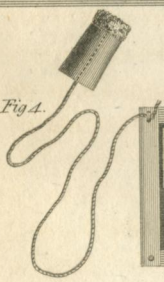


Fig. 5.

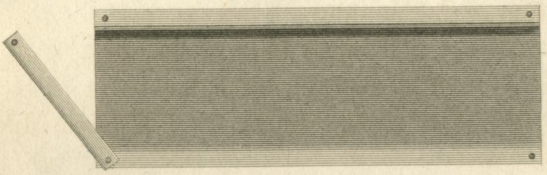


Fig. 6.

Fig. 7.

Fig. 8.

Mr. T. Heyworth's Horn Tablets.

Drawn by M.A. Nicholson.

Engraved by Jas. Davis.

WILLIAM DAY, Conduit-street.
ROBERT JOYCE, Academy, Wilson-street, Finsbury square.

Especially *for private tuition*, and *Boarding Schools* for the opulent class of society. It may also be serviceable in self-tuition, or practice at home.

JOSEPH LANCASTER.

Reference to the Engravings of Mr. F. FOLSCH'S *Transparent Substitute for a Slate, Plate* 15, *figs.* 1, 2, 3, 4, 5, and 6.

THIS improvement consists in the substitution of a plate of common window glass, finely greyed or roughened on one side, mounted in a proper frame, so as to place copies of writing, drawings, &c. underneath it, to the common slate used in schools, &c.

Fig. 1 shews the front, and fig. 2 the back of one of these instruments, the former having a sheet of writing and blank lines, printed in white, upon a blackened paper, laid underneath the glass, ready to be traced over by the slate pencil, red chalk, steatite, &c. shewn in fig. 2, placed in a leather loop; and which marks, or traces, can be readily obliterated by the sponge fitted to its handle, also shewn in another loop in that figure. Fig. 3 is a section across, through the instrument, shewing the glass retained in its place by a projecting rim of the frame, the copy placed beneath it and retained there by the board, covered with green baize cloth, or other elastic material, being pressed close to the glass; and the board itself is firmly secured by the two turn buckles across it being turned into

into the grooves made in the two sides of the frame to receive them, exactly in the manner of most drawing boards.

Figs. 4, 5, and 6, represent a cheaper manner of constructing this instrument. Instead of a frame, a slip of wood is here shewn, hollowed out, as is more particularly exhibited in the section of it, fig. 5, having a narrower groove next to its back, to receive the slips of pasteboard on which the copies are fixed, and widening above, to fit the greyed glass; this glass is retained in its place by two slips of tinned iron, brass, &c. the edge of one of which is bent down at a right angle, so as, when applied on the top of the slip at one end, it entirely closes that end; the edge of the other is only turned down deep enough to secure the glass in its place, but, at the same time, to permit the slips of pasteboard, or copies, to be placed under the glass, or drawn out at pleasure; and for this purpose they are made rather longer than the slip of wood. This last slip of tinned iron, &c. is firmly rivetted to the instrument, whilst the other is so contrived as that, by unscrewing a brass loop at one end of it, it can be turned round the rivet at the other end of it, so as to permit the glass to be taken out occasionally. To this loop is also attached a sponge, made by gluing a piece of sponge to the end of a cork, through which a string has been previously passed, and secured from being drawn out by a knot tied upon it.

The particular advantage of this transparent substitute for a slate, is the great facility with which the copies of writing, drawings, &c. can be removed, and others substituted in their place.

FIVE GUINEAS *were this Session voted to Mr.* THOMAS KEYWORTH *of Sleaford, Lincolnshire, for his Method of Instructing Poor Children to Write in a cheap and easy Manner on Horn Tablets. The following Communications were received from him, an explanatory Engraving is annexed, and Tablets on this Construction are preserved in the Society's Repository.*

SIR,

I BEG leave to refer to the consideration of the Society of Arts, &c. a method of teaching the art of writing by means of transparent horn. I am inclined to wish that the knowledge of this invention was diffused, not merely because it appears of some value, but chiefly, because the more it is known the more likely it will be, to receive those improvements of which it is susceptible. I shall be glad if the information will be gratifying to the Society.

I am, Sir,
Your humble servant,
THOMAS KEYWORTH.

Sleaford, Lincolnshire, May 1st, 1814.

To C. TAYLOR, M. D. SEC.

Reference to the Engraving of Mr. KEYWORTH'S *Horn Tables.* See Plate 15.—Fig. 7 and 8.

The mode of constructing the tablet is as follows. A piece of board is provided, about eight inches long, four inches broad,

broad, and half an inch thick, see fig. 7, this board is made with what is technically called a *feather-edge*, see sect. fig. 8. By this means, when laid upon a flat table the upper side presents to the view an inclined plane with an even surface. On this board a copy written upon paper is posted. This copy consists of only two or three lines, the upper one being usually filled with letters, written in red ink, but the lower one's ruled with black ink and left blank. A piece of horn, such as lanthorns are made of, is procured, large enough to cover both the written and the blank lines of the copy. After this horn has been soaked in water half an hour, it is laid upon the copy as smoothly as possible, and fastened to the board with small nails, as shewn in fig. 7. A nail or stud is also inserted near each of the upper corners of the board, see fig. 7 and 8, whose head remains about one-eighth of an inch above its surface. One side of the tablet is now finished. Another copy, horn, and couple of nails, are fixed in a similar manner on the other side of the board, and the tablet is completed. This description will be rendered plainer by referring to fig. 8, in which the feather-edge of the board are shown, its thick edge, and the projecting nails; the word *king* is written between the upper lines of the copy, and the small nails with which the horn is fastened to the board, are shewn as well as the two nails or studs which project from the surface.

The manner of using the tablet is next to be stated.—When the children assemble for writing, every one is required to bring a piece of soft rag, and a bag containing a small quantity of dry whiting. The teacher then furnishes each child with a tablet, ink, and a pen made somewhat harder and finer nibbed than those used for writing

writing on paper. The scholar begins by tracing upon the horn the writing or different strokes which are discerned, in the copy beneath it, who then attempts to imitate the copy, by writing on the blank lines, when they are also filled, the child turns the tablet over, and acts in a similar manner with the copy there; the nails which project above the surface of the tablet serving to keep what was written on one side from being smeared while the child writes on the other. When both sides are filled, the child then holds up the tablet over its head, as a signal for the teacher, who takes the tablet, examines how the writings are executed; if badly, he orders the child to wipe the copy dry, and to write it over again, but if well written he gives the child a second tablet, with which it proceeds as with the former. By this time, a second child is waiting for the teacher, who receives the tablet, examines it as before, and if well written, he gives the second child the tablets which he had received from the first .This tablet the child finds has been written upon, and therefore takes the soft rag and wipes it clean and dry, but sometimes the hands of the children render the horn a little greasy, in which case it will not take the ink; this inconvenience is obviated by dusting a little whitening upon the horn, and then wiping it clean.

The advantages which are supposed to result from this method of instructing children to write are various. They are usually taught to write either on paper or on slates. Writing on horn seems to be superior to either of these; superior to writing on paper, because it is attended with less expense: if the tablets be made in the cheapest way, viz. by producing such pieces of horn, as are not suffi-

ciently large to be used in making lanthorns, consequently are of scarcely any value to the manufacturers; a tablet for two lines may be had for three-pence or four-pence, and when once provided will last for many years. It is attended with less trouble to the teacher, for no lines require to be ruled, and the pens last at least four times as long without mending as they would were they used on paper. It greatly assists the learner in forming letters; in writing on paper the copy is placed before him, and he must imitate it as well as he can; but in writing on horn tablets, the shape of each letter is discerned through the horn, so that any one who can hold or guide a pen may trace over the strokes which he sees in the copy beneath. The method now explained, seems to be preferable in some respects to that of writing on slates. It approaches much nearer to writing on paper. The transition from pencil and slate to pen, ink, and paper is so great, that children who can form their letters tolerably with the former, often do very badly with the latter; but the learner writes with the same instrument upon horn which he is afterwards to use on paper. What has just been said, with regard to *the assistance in learning to shape the letters, and join them together, which the child receives by this method, points out another advantage which it possesses over writing on slates.* This assistance is so great, that I believe a child will learn to write on horn in half the time it would either on paper or slate. I shall only add, that by this method the children write a much greater number of lines in a given time than they do when they write on paper. When those of the schools with which I am connected, wrote on paper, they commonly filled two pages each in an evening, consisting of about *twelve lines;*

lines; but now that they write on horn, a child will often fill sixteen tablets, amounting to *sixty-four lines.*

Some objections are made to this plan of teaching; these we purpose to notice: "If the copy consists of several lines, the letters which are first formed will become so dry before the whole copy is written, that there is difficulty in wiping them off the horn;"—but it may be replied, why should copies consisting of many lines be used? Such require large pieces of horn to cover them, and are much more expensive in proportion than smaller ones, besides, if a large piece of horn become damp (which it will do when written upon) it will not lie flat upon the board, but will be puffed up in the middle, and the writer will find the tracing of letters upon its surface very unpleasant. It is objected, "if the tablets are small they will require changing very often."—True, it will be necessary to change them every time a child has written four lines. But it should be remembered that there is no more trouble in changing a tablet, than there is in inspecting it, and will any one say that a child should be suffered to write more than four lines without his performance being examined.

Writing on horn has been adopted during the last two years in the school which I superintended, and experience has proved that it possesses the advantages mentioned. These were particularly apparent in the improvement of a very dull scholar, who had gone through the alphabet several times on a slate, yet could not join two letters together, but she very soon learned to write decently by this method, and the regularity of shape, slope, turn,

&c. which it soon induced in the writings of the more forward scholars was truly surprising.

In enumerating the advantages which this plan of writing on horn possesses over that of writing on slates, I might have mentioned one which, I believe, teachers will allow to be of considerable consequence: it is much more pleasing to the children, and whatever conciliates their affection is important. So far as I have had an opportunity of judging, there is no reward which can be given to Sunday School children for the same expense which they will esteem so much as being taught to write. Should the statement now given, be a means of introducing in any degree a more pleasing, a cheaper, or a more expeditious way of gratifying them than those in common use, I shall not think the time which I have bestowed upon it thrown away. I am aware, that the great objects of Sunday Schools (and they are those which I should wish ever to keep in view) are to habituate a number of children to regular attendance on the worship of Almighty God, and to impart to them religious instructions; and, when I view these objects, I am convinced, that they are of infinite moment, that they deserve all the attention which has been given them, and that they are of far greater importance than the mere teaching of children to read or write. These are useful arts, and they do well who teach them on Sabbath and week days to Sunday School children; and it appears that any improvement in teaching children to write, which either diminishes the expense, facilitates the operation, or renders it more pleasing, deserves attention, because it is

an

an improvement in that by which children are induced to attend where religious instruction is given them.

THOMAS KEYWORTH.

The SILVER MEDAL AND FIVE GUINEAS *were this Session voted to Mr.* J. STONE, *of Warwick Street, Golden-square, for a Double Spring to a Door, enabling it to open inwards or outwards. The following Communication was received from him, an explanatory Engraving is annexed, and a Door is hung on this Principle in the Antichamber of the Society.*

SIR,

HAVING invented a double swing door spring, I have herewith sent a model of a door hung upon this principle which I request you to lay before the Society of Arts, &c. for their inspection.

I am, Sir,

Your most obedient Servant,

JAMES STONE.

No. 30, Warwick Street, Golden square.
February 15th,

To C. TAYLOR, M.D. SEC.

CERTIFICATE.

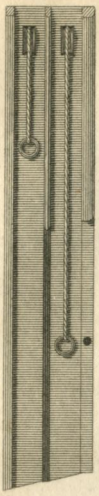
A Certificate was received from Mr. J. TOMKINS, of Bevis Hill, Southampton, dated February 1814, addressed

to Mr. STONE, informing him that he had remitted him £.2 for one he had received, and that he thinks the invention a very good one, and such as must succeed.

Reference to the Engraving of Mr. JAMES STONE's *Door-spring. Plate* 16, *fig.* 1, 2, 3.

Plate 16, fig. 1, a double spring affixed to a door, by which it opens equally well inwards or outwards; *a b*, fig. 1, two barrels containing two spiral springs on one axis, wound contrary ways; this axis is squared into the spring frame *c c* to keep it from moving round, and at each end is a pivot which enters into the door; these pivots keep the door from being forced away from the springs, so that their action is always certain. Two brass plates *d d* are screwed on the door to receive the pivots; the pivot holes are open at the back as in fig. 2, which is needful, to get the door on to the springs, for the springs being first screwed on the door-post, the door is opened at right angles to the door frame, and then slid on. The door is hung on pivots, the bottom pivot is fitted into the door at *e*, and the top pivot is rivetted into a plate of iron screwed upon the top of the door, and enters the door frame at *f*. The pivot lower hole is of brass, and screwed in the floor, coincident with the axis of the springs. The hole is turned a little wider at the bottom to hold oil. There are stops on each barrel *k l*, fig. 3; the stop *k* is on the lower barrel as fig. 1, and prevents the spring from acting farther than to shut the door, and the stop *l* on the other side of the upper barrel is to prevent the spring from acting farther than to shut the door the other way, by which means,

Mr. C. Wilson's
Sash Window.



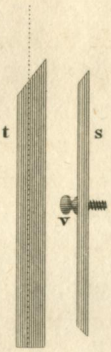


Fig. 4.

Mr. I. Stone's
Double Door Spring.

Pl. 16.

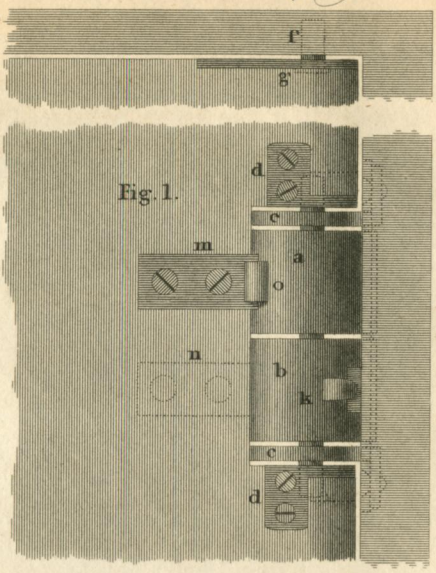
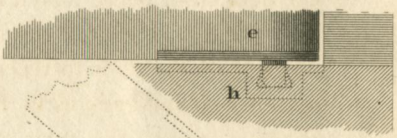
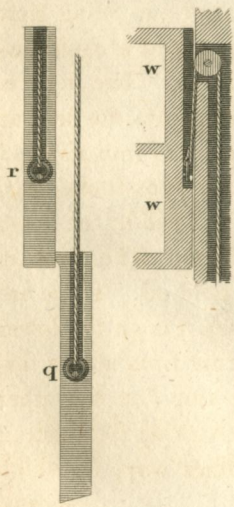


Fig. 1.





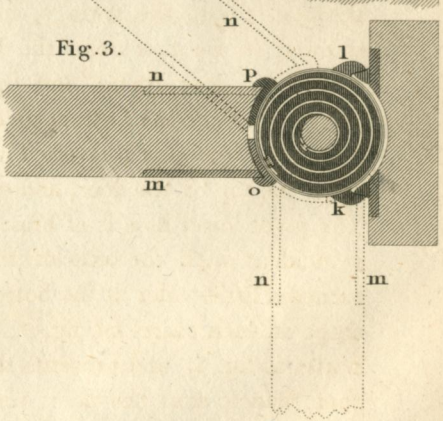


Fig. 3.

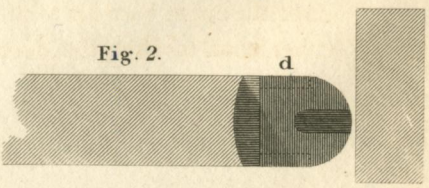


Fig. 2.

C. Varley del.

G. Gladwin sc.

means, the springs remain wound up enough to hold the door when shut with the required firmness. *m n* are plates screwed on the door after it is hung, to catch in the hooks *o* and *p*, by which the springs act on the door; when the door opens on the side *n*, it carries round the barrel *b*, fig. 1, by the hook *p*, fig. 3, as shewn by dotted lines, and when open on the side *m*, it carries round the barrel *a*, fig. 1, by the hook *o*, fig. 3, shewn also by dotted lines. These springs being thicker than the door, the extra thickness is let into the spring plate and door-post, as shewn in fig. 3, and by dotted lines in fig. 1, by which means the door lies flat against the door post when open.

The Society, besides having in their Repository a model of Mr. STONE's double door spring, have likewise had one of the doors of their house, which is most frequently used, hung in the above manner, with one of them affixed to it, as a farther proof of its efficacy, and with the most complete success.

FIVE GUINEAS *were this Session voted to Mr.* C. WILSON, *Worcester-street, Borough, for a Method by which Sash-windows can be cleaned or painted without Danger to the Person employed. The following Communication was received from him, an Explanatory Engraving is annexed, and a Model of a Sash-window hung upon this Construction is preserved in the Society's Repository.*

SIR,

I request the favour of you to lay before the Society of Arts, &c. my invention of a method by which sash-windows may be so hung as to be cleaned or painted without danger to the person employed. By this means, many lives may be saved, and accidents prevented, besides a general advantage arising to the public. Hoping the Society will take it into consideration, and reward it according to its merit.

I am, Sir,

Your obedient humble Servant,

CHARLES WILSON.

No. 33, *Worcester street, Borough,*
October 30th, 1813.

To C. TAYLOR, M.D. SEC.

Reference to the Engraving of Mr. C. WILSON's *sash-Window. Plate* 16. *fig.* 4.

Fig. 4 is a section of a sash-window frame, the sash lines having rings fastened to them to hook on to, or off the head of a screw placed in a hollow made in the side of

of the sash, as at *q* and *r*, at the bottom of the groves which are also made in the sides of the sash for the line, and each screw head is flush with the surface, so that the rings cannot get off, whilst the sash is in its place; *s* and *t* represent the lower halves of the bead and middle slip, one of which will stick in its place, and the other can be fastened by the screw *v*; these will take out, so that both the sashes can be taken into the room, and the sash line separated from them; and they may there be cleaned or repaired without the dangerous trouble of going outside the window. *w w* is a section of the sash and pulley shewing the ring of one of the lines hung upon the head of the screw in the hollow of the sash, as before described.

The SILVER MEDAL *and* TEN GUINEAS, *were this Session voted to Mr.* T. BOYCE, *Dean street, Fetter Lane, for his Invention of a Life-Boat or safety Buoy. The following Communications were received from him, explanatory Engravings are annexed, and a Model is preserved in the Society's Repository.*

SIR,

THIS is accompanied with the model of a life-boat, raft, or buoy which probably may be found not unworthy of the patronage of the Society of Arts, as in my humble opinion it combines superior powers with greater simplicity and accuracy than any invention of the kind which has hitherto come under my observation. The principle upon

upon which this boat is constructed, is such as to give it a superiority in point of steadiness, to any other construction. It can never be impeded by being water-logged, nor is it half so liable to be upset as a boat upon the keel or flat-bottomed principles. These latter may by expensive means be so contrived as to prevent them from sinking, but they may become water-logged, and consequently unmanageable in a rough sea, and it is a matter equally bad, whether a man perishes within a boat or without one, and in the event of such boats upsetting the persons who happen to be caught under them, can have no chance for life, and the bottom upwards can afford but a poor refuge to those who gain the outside.

The pendulum motion of the keel boat, and the aukward principle of the flat boats in case of violently rolling with much water on board, render them highly precarious in cases of extreme danger.

A boat or raft upon the plan which I respectfully submit to the Society, is constructed upon the most buoyant and simple principles, and it can be carried by two men from one part of the ship to the other. It may be made of wooden laths nailed upon circular wooden frames forming two cylinders with a pointed end; these frames have arms which divide each cylinder into five compartments, which may be either left open within, or filled with cork, or each made water tight. The frames are secured together by bars extending across through both cylinders. Upon the outside of the cylinders should be placed a coat of linen or cotton cloth, secured with water proof size or cement, over which two or three layers of brown pitched paper well cemented should be laid, over that another layer or coat of linen or cotton cloth should be cemented, and, lastly,

lastly, a covering of strong canvas well secured, cemented and painted.

This boat is so contrived that it is immaterial which side lies uppermost in the water, as both sides are separately supplied with a similar set of masts, sprit sail and rigging ready for setting up, and when the boat is cut away from the part of the ship where it hangs ready for use, the man fallen overboard, when he gets upon it, can hoist that mast and sail which lies uppermost, and follow the ship with nearly equal speed. The paddle answers the purpose of a rudder to steer by, and one paddle only is necessary, as it can easily be drawn out whichever side is uppermost.

The proper length of the boat is about nine feet. The diameter of each cylinder twelve inches, and the width of the grating between them twelve inches. The length of each mast nine feet, with sails and sprits in proportion. The weight of the whole about 180lb. and the price about ten guineas, and it will carry 250lb. weight with the grating clear of the water. The size or cement for uniting and covering the apparatus, should be made from equal weights of mastic, incense, rosin, and fine-cut cotton or cow hair; these are to be melted together with some powdered calcined oyster shells, and all mixed while boiling into a strong mass, which grows harder the longer it lies in water. Where calcined oyster shells cannot be got, quicklime will answer as a substitute for it.

Besides the saving of the lives of persons who fall overboard, this boat has the advantage of being able to carry a person safe to land where no other boat could venture, and convey a rope or dispatches on shore, that would be the

the means of preserving both ship and crew in cases of great emergency.

If my humble efforts should contribute towards the preservation of any of my fellow creatures, it would always be a source of happiness to, Sir,

Your respectful humble servant,

THOMAS BOYCE.

No. 15, *Dean Street, Fetter Lane,*
January 19, 1813.

To CHARLES TAYLOR, M.D. SEC.

*** It appeared from information given to the Committee of Mechanics, that a small boat, on this principle, was dropped from the bridge at Monmouth, when the stream was very rapid, and, on a man getting upon it from a boat, it did not sink to the depth of the grating with him, and he was enabled to sail against the stream in it.

Reference to the Engravings of Mr. BOYCE's *Life Buoy, or Boat.* See Plate 17. Figs. 1, 2, and Plate 18.

FIG. 1, shews a bird's-eye view of the life-buoy, *a a a a a a a a a a*, the bulk-heads, or partition, denoted by dotted lines, which form the five principal cross bars of the grating dividing the two cylinders with the angular end into ten water-tight compartments; *b b* the sail-mast, sprit, and paddle, tied up in canvass, which is secured along the middle of the wooden grating which connects the two hollow cylinders; this grating is made with thin bars, across three principal longitudinal bars, their ends covered by long thin slips of wood, *c c c c*; *d d d d d* are five rings to fasten the rigging to, shown more distinctly in.

Fig. 2,

Fig. 2, which is a section or end view, showing the two sets of rigging, one above and one below the grating; the dotted lines show the slips of wood placed as spokes to form the partitions in the cylinders; or they may be made of solid wood cut circular.

Fig. 3, shows how the life-buoy is hung to the stern of the vessel, ready to be detached when any person falls overboard.

Plate 18, exhibits a view of a boat of this description under full sail, with a person upon it.

The SILVER MEDAL *was this Session voted to Mr.* THOMAS CLEGHORN, *Old Hall Green, near Ware, for a Buoyant Line to preserve the Lives of Mariners. The following Communications were received from him. Explanatory Engravings are annexed, and Specimens of the Articles preserved in the Society's Repository.*

SIR,

I HAVE sent an account of a new invention, with some models, which I hope you will have the goodness to lay before the Society; and you would greatly oblige me by letting me know, in due time, the Society's sentiments concerning it.

I have the honour to be, with respect, Sir,

Your most obedient servant,

THOMAS CLEGHORN.

Old Hall Green, near Ware,
30th March, 1814.

To C. TAYLOR, M.D. SEC.

An

An Account of a newly-invented Floating or Buoyant Line.

When a man who cannot swim (as is the case with the great majority of sailors), falls from a ship at sea, he often sinks before any assistance can be given him from on board; seldom can a boat be sent in time for his relief; and if any thing be thrown from the ship, with a view to support him, he is incapable of making the least attempt to reach it. This must frequently happen when the life buoy is dropt from a ship of war. It may save many men who can swim till they lay hold of it, but few, if any, who cannot swim; and it is chiefly for these that a new method is here proposed.

Let a buoyant line, from 100 to 400 yards long, be wound upon a reel which turns very easily, something similar to the reel on a fishing-rod, but more simple. To the end of this line let there be attached a wooden float, ballasted so as to carry a vane to show the direction and extent of the line when in the water. The square stern of the float, to which the line is fixed, will prevent the line from being drawn after the ship until it be all run out, or till the fallen man has got hold of it.

Let the reel with the buoyant line be permanently fixed upon the ship's stern, within reach of the man at the helm, and let the float, with its vane, be secured with a cord from falling when not wanted.

When a man falls overboard, let him who is at the helm, or any other person, cut the cord; the float, with the end of the buoyant line at it, will instantly drop astern, and be left behind by the ship, till either the whole of the line be run out, or till it be purposely stopped by a person on

on board, in order to pull up the fallen man who has got hold of it.

As the buoyant line will FLOAT *in the* ship's wake, it seems that a man falling overboard must very soon be carried to it; and even should he be quite incapable of aiming at it, when it touches him, he will, by a kind of instinct, which never quits a drowning person till the last, seize and hold it with all his strength. If the ship be going not less than six miles an hour, the man will be drawn by it so fast as to be kept above water, even without any assistance from on board, which, however, would almost always be given by turning the reel and winding up the line.

This plan might prove very useful for merchant ships. From which when a man falls, a raft of empty casks, or pieces of timber, with a rope tied to it, is sometimes thrown overboard, which, at best, gives him but a poor chance, especially if he cannot swim. He will often be lost before such a raft can be prepared; but even supposing it to be always ready, and instantly thrown over board, the man must be singularly fortunate who, being no swimmer, can notwithstanding seize and hold by the raft itself; as a common rope tied to it, sinking in the water, cannot (like the buoyant line) help him whilst he is between the ship and the raft.

It should seem that the life-buoys, which ships of war have for the sole purpose of saving men who fall overboard, would be more useful than they are at present, had each of them attached to it a buoyant line of 200 or 400 yards long; with it the fallen man would have a chance of being saved, by laying hold of any part of the line between the ship and the life-buoy, as well as of the life-

buoy

buoy itself, which, as used at present, is here supposed seldom to be seized by a man at more than the distance of 400 or even 200 yards from the ship, unless he be a very good swimmer.

When a fallen man lays hold of a life-buoy without a line, as it is now used, he may sometimes remain hanging to it till he perishes with cold, or hunger, or be devoured by a shark, especially if he fall in the night.

Life-buoys without lines must often be lost, but with buoyant lines they would always be recovered, whether they had been successful or not in saving lives.

A buoyant line attached to a life-buoy, or float, or without either, being let go at any time of the day, or night, would almost inevitably come in contact with a man as soon as he reaches the ship's wake, and in a manner compel him to take and keep fast hold of it.

The buoyant line might occasionally, on dangerous services, by way of precaution, be let go into the sea, and there left extended till any apparent danger of men's falling be over. It would not retard the ship's motion; and, should a man happen to fall, he would have a good chance of being saved by laying hold of any part of the line, or the float at its end, which could not be drawn out of his reach by the ship till it had gone 400 yards (this being the line's length) from the spot where the man had fallen.

Should a man fall so far from the ship as not to be immediately carried into the wake, by turning the ship's head but a very little towards the side where the man is, the buoyant line would soon be drawn to him.

Were a man to fall overboard in the night, a person near the reel, by letting the line run lightly through his hand, or feeling, as an angler does, to know if any thing

is

is at his hook, would perceive when the man had got hold, and, of course, assist him by winding up the line, and drawing him towards the ship.

Any number of men might be saved by the method here proposed, the line being sufficiently strong for the purpose.

The Method of making Buoyant Lines and Ropes.

Many attempts have been made to find *one* pliable substance sufficiently strong to make a neat rope, or line that would float in water. Before these attempts, the only floating ropes known to the writer of this Essay, were such as are used in the Mediterranean, made of a kind of rush, growing in Spain, named *espurto*, or *esparte*, and those made in India from the rind of the cocoa-nut; but it appears, from experiments, that their buoyancy is entirely owing to the rough, unfinished state of their yarns, and the loose manner of laying them, which would render them very inconvenient and unwelcome on board of English ships. The fibres of each of these two substances, when properly combed and cleaned, have been found to sink in water, like hemp, and many other substances tried in the same manner; from which it should seem that there is no *one* substance fit for making a neat, strong, buoyant rope or line, and that the best kind yet discovered, consits of *hempen webbing*, or *flaxen inkle, with a heart of cork* sufficient to make it float in water. Hemp, flax, and cork, last very long without injury from being often wet and dry. Of these, models are sent for inspection, though very imperfect, for want of proper materials,

and practice in making them, as must often be the case with new inventions. It is hoped that they will suffice at least to give an idea of what they might be, were they to become an article of trade, as they would, if approved of, and introduced into ships in general. Then would webbing, inkle, &c. of a proper kind be made, and very cheap. The cork, it may be said, would cost nothing, as only old bottle-corks would be wanted, and the cutting and enclosing the cork in the webbing, or inkle, might be done at a trifling expence, and would be good employment for poor women and children.

A buoyant line 400 yards long, and of sufficient strength when on the reel, would form a cylinder of only about 28 inches in length and $4\frac{1}{2}$ inches in diameter, or any other dimensions in proportion. It might be made and placed on a ship's stern, so as to prove no wise cumbersome nor inconvenient; and its appearance might be made even ornamental.

Though the models of the buoyant lines have each a *seam*, it is not liable to give way like a common seam, when the thread breaks. The thread of the seam is here in a manner interwoven with the substance of the line, and if accidentally broken, will not injure the line any more than would the breaking of a yarn of the line itself.

The buoyant lines, from their make, must be stronger than common spun lines of the same weight of hemp, and they are not liable to twist and entangle like spun lines.

A sketch is sent with intent to show the method of using the buoyant line. Should any further explanation be required, it will be given most readily to the utmost of the writer's power, independently of any pretension to the honour

honour of a premium. He would think himself well rewarded were the Society to judge his idea worth sufficient notice to recommend it to the consideration of the public, that it might be taken up by some more able hand, improved, perfected, and adopted for the Society's chief object, viz. *the good of mankind!*

THOMAS CLEGHORN.

Old Hall Green, near Ware,
30th March, 1814.

The models of buoyant rope and lines sent are,

No. 1, a 17-10th inch of buoyant rope, 7 inches and a quarter in circumference, showing the proportions of hemp and cork to make a rope, or line, which will float in fresh water.

Their relative weights are nearly 15 of hemp to 1 of cork.

No. 2, a strong 1 4-10 inch rope, the heart of cork, covered with brown hempen webbing, or 1½ inch wide.

No. 3, another of the same, only 12-10th of an inch in circumference.

No. 4, a line with a heart of cork *doubly* covered with white flaxen inkle, 1 inch wide.

No. 5, another of the same, *singly* covered with the same inkle.

No. 6, another of the same, covered with inkle 6-10th of an inch wide.

N. B. The webbing was manufactured for the purpose, as nothing of the kind could be found ready made; nor had the maker a loom for weaving small webbing fit for a line of the size of No. 6, which, if made, would be very

proper for the reel, and greatly preferable to the inkle, which has been substituted in its stead, for the three last models.

SIR,

HAVING considered an objection made to the use of the buoyant line, that from the height of the situation of it from the water, a man fallen overboard might pass under it without being able to get hold of it; my opinion is, that the *weight* of the buoyant line, which will be considerably increased when wet in the sea; the weight of the atmosphere and the force of the wind continually pressing downwards the part of the line between the reel and the water, together with the slightness of the float's resistance, will never let the ship draw the line so tight as to raise any considerable part of it above the water, even when the whole line is run out, and the reel of course stopped. Suppose, however, a fallen man to be close to the ship, and the spot nearest to it where the line touches the water, to be 30 yards astern; if the ship be going only at the rate of six miles an hour, it would bring the point of contact of the line and water to the man, in nearly ten seconds. But cases of this kind will seldom or never happen, because the reel will turn and veer the line with such velocity, that it will always continue falling into the water very near the ship, until it be all run out, or till the reel be purposely stopped by a person on board.

Floating lines or ropes will probably be made useful for other purposes, as well as for saving men who fall overboard.

Many experiments were lately made on the coasts of Kent

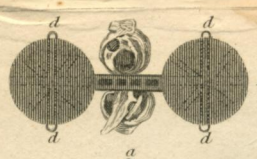


Fig. 2.

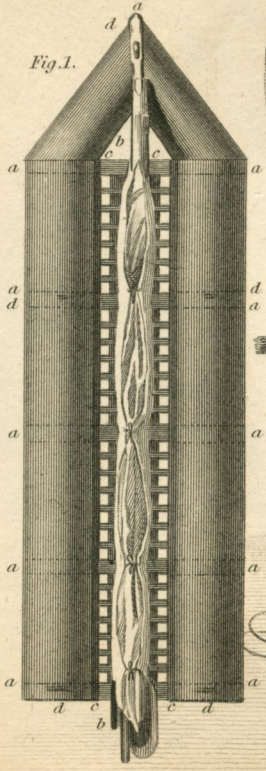


Fig. 1.

Fig. 3.

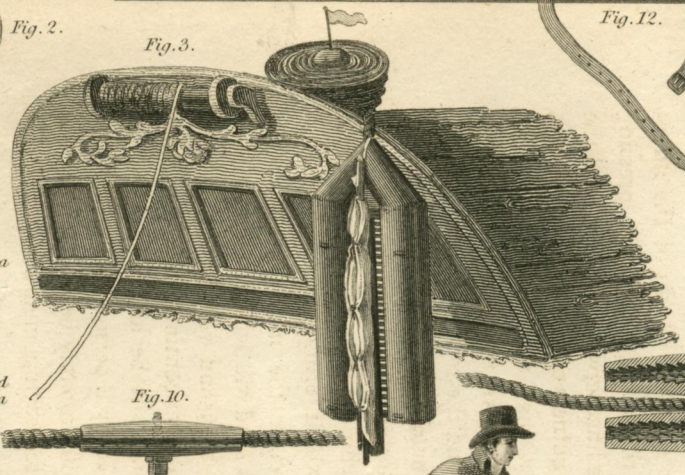


Fig. 12.

Fig. 4.

Fig. 5.

Fig. 6.

Fig. 9.

Fig. 8.

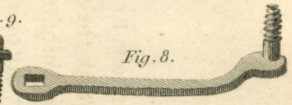


Fig. 10.

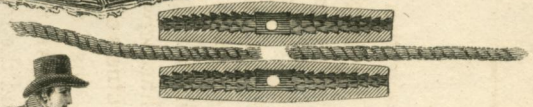


Fig. 7.

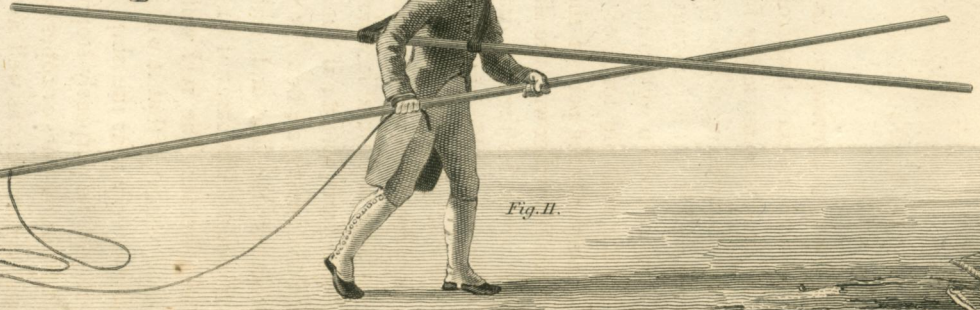


Fig. II.

C. Varley del.

A. Warren sculp.

Mr. Boyces Life Buoy, Mr. Millers Safety Poles, Mr. Cleghorns Buoyant Line; and Mr. Scotts method of uniting Standing Rigging when broken.

Kent and Sussex, when the wind and tide were against the land.

From a boat 150 or 200 yards off the shore, was thrown a buoy, with a floating line attached to it. Thus it always landed; but with a common line it only went about 40 or 50 yards from the boat, and then stopped, being held as if at anchor by the weight of the line, even where the bottom was smooth sand, and much more where there were stones or weeds.

These experiments were made with a view to establish a communication between vessels stranded near the shore and the land. They were repeated both when the sea was smooth, and when there was a high surf. But it has been objected to their utility, that vessels are only wrecked in storms, when the tide usually runs so strong along the shore, as to prevent from landing any thing (from a ship) with a line attached to it; granting this, it might still perhaps be useful in the Mediterranean, and on other coasts where there is either no tide, or where it does not run along the shore.

If the Society should honour with their consideration the little essay and models I addressed to you, expressing their sentiments concerning it, it would be highly esteemed, and if any other explanations were required, I would endeavour to give them to the best of my power, in writing or personally.

I am much indebted to you for your obliging civility, and have the honour to be, with respect, Sir,

Your most obedient Servant,

THOMAS CLEGHORN.

Old Hall Green, near Ware, April 18th, 1814.

To C. Taylor, M.D. Sec.

Further Answers to an objection made to the use of the Buoyant Line.

It has been objected, that the end of the buoyant line would, sometimes, drop into the water between the ship and the fallen man, and that the man being thus astern of the line's end, it could be of no service to him.

In answer to this objection, it may be observed, that supposing the man to be astern of the line's end, if he could not swim at all, he would probably be unable to lay hold of it; but, if he could swim, however little he might reach it, as it must drop into the water very near him (if let go immediately on his falling) and remain almost in the same place till the whole line be run out; granting, however, that in this case, the buoyant line could be instrumental in saving those only who *can* swim, for them alone, it might be worth adopting. But, from experiments just made, it appears, that cases such as that proposed, may be almost entirely prevented; thus—

Should the *reel* be approved, let the line be wound upon it all *excepting* 30 *or* 40 *yards*. Let these be carefully *coiled* in a small tub or basket. Instead of a *float with a vane* (which is not essential,) let there be affixed to the end of the buoyant line a piece, or ball of wood of the properest shape and weight for throwing, which, when not used, would be placed upon the coil close to the reel. When a person falls overboard, let the most expert thrower nearest the coil, take up the wooden ball, and either throw it from his hand, as he would a stone, or heave it as he would the lead, right along the ship's wake. In this manner it is thought he might send it 30 or more, but at least 20 yards

yards astern the ship, and some way beyond the fallen man, by which means, the line would either drop directly upon him, or so near to him that he must almost instantly feel and lay hold of it.

The reel, it is thought, would be found very convenient for veering, for quickly winding up the greatest part of the line, and for keeping it always ready for use; but should seamen object to it, instead of 30 or 40 yards (as has been proposed) *the whole line* might be coiled and kept always ready for use, in a small tub or basket, having a wooden ball fixed to its end, to be used when wanted, as has been mentioned.

By either of these methods, no time would be lost in cutting a cord as was at first proposed, and the line's end (with the ball) instead of dropping perpendicularly, would fall at least 20 yards astern of the ship, whilst the man would be between them, in a favourable situation to be saved by laying hold of the buoyant line.

Reference to the Engraving of Mr. THOMAS CLEGHORN'S *Buoyant Line. See Plate* 17, *figs.* 3, 4, 5, *and* 6: *and also Plate* 18.

The buoyant line may be placed for use in the two following methods.

See fig. 3, where the buoyant line is either wound on a reel fixed to the stern of the vessel and where part of the line is seen running out, or it may be coiled up in a tub, as shewn in the vessel near fig. 3, with a floating ball and vane fastened to its end, laying in the middle of the

coil ready to be thrown out when a person falls over-board, which float and vane marks the extremity of the line, and point it out to the suffering person.

Fig. 4, a part of the buoyant line formed of corks, through which a string is passed in the manner of stringing beads, enveloped in strong webbing or tap, and firmly sewed and secured.

Fig. 5 is a longitudinal section thereof, showing the manner of connecting the corks, and the envelope of webbing in which they are secured.

Fig. 6 is a cross section showing the cork and manner in which it is enveloped by the webbing.

Plate 18 shews the buoyant line floating from the ship to the vane, and two persons in distress taking hold of it.

The GOLD ISIS MEDAL *was this Session voted to Mr.* G. SCOTT, *of George-street, Tower Hill, for his Method of uniting the standing Rigging of Ships when broken in Action. The following Communications were received from him, an Explanatory Engraving is annexed, and the apparatus is preserved in the Society's Repository.*

SIR,

A YOUNG man from Alnwick, named GEORGE SCOTT, having lately invented a very expeditious mode of uniting the standing rigging of a ship, which appears from its extreme simplicity likely to be of much service; I feel anxious

ous that the invention should be submitted to the consideration of the Society of Arts.

I am, Sir,

Your obedient servant,

PERCY.

Northumberland House, Dec. 1st, 1813.

To C. TAYLOR, M.D. SEC.

SIR,

I BEG leave to submit to the inspection of the Society of Arts, &c. a method of uniting the standing rigging of a ship when broken in action. By which means, in the course of half an hour, a ship whose rigging is damaged, may be again prepared for action in a better manner than can be done in the common way in many hours. From repeated experiments, I have found that the rope would be more readily broke in any other part than in the place thus united. I have ascertained this effect by a crane. A broken rope can be thus united in half a minute. Frequent cases have occurred, where from ships being damaged in their standing rigging, they have been captured by vessels of inferior force, and which, by this means, might have been prevented.

I am, Sir,

Your humble servant,

GEORGE SCOTT.

George Street, Tower Hill, Dec. 2d, 1813.

To C. TAYLOR, M.D. SEC.

Reference

Reference to the Engraving of Mr. SCOTT's *Method of uniting standing Rigging when broken in Action. See Plate* 17, *fig.* 7, 8, 9, 10.

Fig. 7, two semi-cylinders made of iron, within which the two ends of the broken rigging is to be laid, and secured by a screw fig. 9, which is screwed up tight by the key or winch fig. 8; the interior of the two semi-cylinders is toothed like a rasp to penetrate and so firmly hold the two ends of the rope, as to prevent their separation.

Fig. 10 shews the ropes so connected by the screw and semi-cylinders.

At one end of the key, fig. 8, is a screw to fasten the semi-cylinders together speedily, when only one rope is broken.

The THANKS *of the Society were this Session voted to* JOHN MILLER, *Esq. of Bedford, for his Method of Preserving Persons from Drowning when the Ice breaks under them. The following Communication was received from him, an explanatory Engraving is annexed, and a Drawing sent by him preserved in the Society's Repository.*

DEAR SIR,

I HAVE long had at several places contiguous to the river at this place, an apparatus in readiness to afford assistance in case of any one being in danger of drowning from the ice breaking under him. It is very simple, and I am persuaded would on trial be found efficacious.

It consists of two poles, each twenty feet long, cut out of

of a two inch deal plank. A leather strap to buckle, long enough to go over a person's shoulder, is fixed to one of them. The person using it grasps this pole with one of his arms and there fixes it, by means of the strap going over his opposite shoulder. The other pole, to one end of which a cord is fastened, he carries in his hand, for the purpose of conveying it to the person in distress, and which, by means of the cord, he is enabled to do at a very considerable distance.

The pole which is fastened to the assistant, from its projection of ten feet both before and behind him, must secure him, unless one can suppose (what is not likely,) that the ice under him will break to the whole extent of the pole, twenty feet before he can extricate himself.

Had an apparatus of this sort been at hand, the life of the person who was drowned in his attempt to rescue another in St. James's Park on Sunday, would most certainly have been saved.

A friend of mine has had the goodness to sketch a representation of it, which I have the honour to send you, requesting the Society's acceptance of it.

Permit me to add, that I believe a pole twenty feet long will of itself prevent the assistant's sinking, even if the ice should break for the whole length of it; but should a greater degree of buoyancy be thought requisite, a small quantity of cork fastened either to the middle or ends of the pole, would most assuredly give it buoyancy enough to support any person's weight.

I have the honour to be, Dear Sir,
Your most obedient Servant,
JOHN MILLER.

Bedford, Feb. 21st, 1814.

To C. TAYLOR, M.D. SEC.

Reference to the Engraving of Mr. J. MILLER'S *safety Poles. See plate* 17, *fig.* 11, 12, 13.

Fig. 11 shews a man, secured from danger by one pole being placed under his arm, and strapped round his shoulder, ready with another pole and line to throw to a person in distress from the breaking of the ice; one end of the line is to be retained in his hand, the other being fastened to the end of the pole.

Fig. 12 shews one of the poles and the straps attached to it.

C. Varley del.

A. Warren sculp.

Mr. Cleghorns Buoyant Line & Mr. Boyces Life Boat or Safety Buoy.